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Edmund Montgomery Foster
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ELEMENTS
OF
BOTANY;

CONSISTING OF THE
ANATOMY AND PHYSIOLOGY OF PLANTS;

An Explanation of
THE CLASSIFICATION OF PLANTS BY LINNÆUS;
AN ARRANGEMENT OF MEDICINAL PLANTS;

AND A
GLOSSARY OF BOTANICAL TERMS.

SECOND EDITION.

With Plates.

BY JOHN STEGGALL, M.D., &c.

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PREFACE.

IN publishing a second edition of an elementary work on Botany, the paramount object has been to condense into the smallest possible space, the best established points connected with the anatomy and physiology of plants. The facts are principally stated upon the authority of De Candolle, Mirbel, Gærtner, and Richard; therefore, this little work may be considered as a compilation or compendium of their opinions.

The brevity of the following pages will not admit of any lengthened description, even to the extent which the subject merits: and, indeed, it is uncalled for, since so many cele-

brated authors may be consulted in their writings, by those who wish to enter more deeply upon the science. The work is particularly intended for the use of medical pupils, to whom the author trusts it may be of some assistance, and excite their curiosity to obtain further information on this interesting branch of their studies.

JOHN STEGGALL.

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INTRODUCTION

TO

BOTANY.

BOTANY is a branch of Natural History devoted to a consideration of the vegetable kingdom, in reference to the structure, varieties, and uses of Plants.

The most important benefit derived from this study consists in acquiring a knowledge of the salutary and deleterious properties of plants, whereby they are rendered available for domestic purposes, in the arts, or in the practice of medicine.

Vegetables are organised living substances deprived of voluntary motion, having neither nerves, muscles, nor a central cavity like a stomach, and generally fixed to the ground, from which they derive nourishment and support.

They are distinguished from animals by the above characters, by their mode of receiving nourishment, their chemical composition, and by the changes they produce in the elements of the atmosphere. The former are supported by inorganic substances, as gases, water, salts, &c.; they contain an excess of carbon, and exhale oxygen gas in considerable quantity: the latter are nourished by organised animal and vegetable bodies; they contain an excess of nitrogen, and exhale an abundance of carbonic acid, but never simple oxygen.

The vegetable kingdom, taken collectively, presents, to a superficial observer, an immense variety of distinct species, differing in dimensions and appearance; some being the growth and production of one year, others the result and produce of many seasons, extending in some cases to many hundred years. To the largest, most permanent, and solid forms, the term *Tree* is applied; those of less size, but of more than one or two years' growth, and woody in substance, are called *Shrubs*; but the soft tender vegetables which live but for a short period are named *Herbs*.

Vegetables are entirely, or in great part, com-

posed of membranous cells, which are closed on all sides, more or less firmly cemented together, and surrounded in young plants by a membranous cuticle. Plants formed by cells exclusively are called *cellular*; those formed by it only in part, and into which cylindrical tubes called vessels enter, are named *vascular*, or having vessels.

Notwithstanding the difference of appearance in the separate parts or organs, they are all composed of certain simple structures, variously interwoven and arranged. These simple or elementary tissues are described by De Candolle as four, viz. cellular tissue, vessels, fibre, and epidermis, to which may be added some varieties of them less frequently developed. By the union and peculiar arrangement of these, the massive trunks of trees, branches, leaves, and all other parts of the vegetable are formed.

Cellular Tissue.

The cellular tissue consists of a congeries or collection of cells, various in their shape, adherent to each other, but in some cases admitting of separation without laceration. It is found in all plants, and some indeed are formed by it

exclusively, as the Acotyledones. It surrounds the vessels of vascular parts, abounds in fruit, in fleshy leaves, in the medulla, and in the bark of the root: it is more plentiful in herbs than in trees, in young plants than in the old, and appears to constitute plants entirely at their first evolution.

The cells of this tissue are most frequently found to assume four different shapes, which are the *round*, *fusiform*, *tubular* or *prismatic*, and *transversely elongated*. The rounded form appears to be the original one, and it is probable that the shape of the others depends upon the pressure to which they are exposed: when equally pressed on all sides, the cells are hexagonal; but they are elongated and prismatic when the pressure is greater on either side of them. The *rounded* or hexagonal cells are found in the pith, in the cellular envelope of the bark, in the flesh of pulpy fruits, in the parenchyma of the leaves, and in every part of the vegetable which is not disposed to elongation. The *elongated* cells enter into the composition of the wood and cortical layers; they surround the vessels of vascular plants, and alone compose the ribs of leaves and peduncles; they like-

wise form the stems of the cellulares. The *transverse* cells form the medullary rays, and are peculiar to dicotyledonous plants; they are much smaller than the others.

4 The cells are in some places filled with an aqueous juice, in others with air, or with opaque coloured substances: thus they contain fecula in the fleshy cotyledons, in the farinaceous albumen of seeds, and in the parenchyma of tubercles. They enclose coloured particles in the various parts of a plant, and to this substance the term chromule is applied.

5 The cells of the alburnum and cortical layers contain granules of ligneous matter, which adhere to their walls, render them opaque, and produce the remarkable varities found in wood.

6 There are spaces between the cells, called *Intercellular Canals* or *Passages*, varying in their form, but most frequently triangular: they have the same direction, being longitudinal or transverse; they are often filled with water or air, and appear to receive the proper juices.

7 The most remarkable property of the cells or vesicles is the power of uniting themselves together, which is one of the most important functions in the history of vegetation: on this

depends the variety of appearances in the internal tissues, and the union or combination of all the different organs.

A second property of the cellular tissue is that of being excessively permeable to moisture, so as to absorb water brought in contact with it, and particularly that which is conveyed through the intercellular passages.

The third peculiar property of this tissue is that of organic contractibility, without which it is difficult and nearly impossible to explain the course or circulation of the fluids.

Uses of the Cells and Intercellular Passages.
The cells being closed on all sides cannot receive fluids, but by a power of absorption in their walls. Those which are of a rounded form absorb the fluid or sap, and elaborate it in their cavity, giving rise to the production of fecula mucilage, and colouring resinous matter; hence we see these substances abounding in the parenchyma of leaves and fruits. The elongated cells surrounding the vessels contain none of these substances, but appear generally empty or filled with air, thus partaking of the nature of vessels. The Intercellular Passages are generally full of fluid, and it is probable that they mainly con-

tribute to its circulation. In respect to function, they may be divided into three classes:

- 1st. The passages between the cells surrounding the vessels are subservient to the ascent of the sap from the root.
- 2d. The passages between the cells of the medullary rays transmit the sap laterally, from the centre to the circumference.
- 3d. The passages between the rounded cells receive the sap in greater quantity, and the cells thus surrounded imbibe it for elaboration.

These passages, when dilated, produce most of the air cavities and reservoirs of the proper juices of plants.

The Vessels.

9 The vessels which are found in plants have obtained numerous names from the different authors who have examined them; and have been divided in various ways, under erroneous impressions as to their functions and uses: there still remains great uncertainty on the subject. It is supposed by many that they are all modifications of one kind, and that they are merely different in appearance at different stages of a plant's growth. It is likewise supposed that they

are formed simply by cellular tissue, assuming a peculiar vascular form: should they be convertible by age into each other, the spiral must be admitted to be the primary vessel, as it is the one which is always first seen in young plants. They admit of a division into five kinds, deduced from their external appearances:

1st. *Spiral vessels*, or *Tracheas*, are tubes formed by laminae of elastic tissue twisted into a cylindrical form, capable of being unrolled; or they may be said to be arranged like a ribband rolled round a cylinder, forming by its folds a continuous tube. They are most abundant in young shoots: in the old trunks of dicotyledonous plants they are only seen surrounding the medulla, in the sheath of which they seem to form an essential part. In the stems of herbaceous dicotyledonous plants they are found near the centre; they are likewise found in the ribs, on the corolla, and in the sexual organs. They do not exist in the roots of vascular plants, nor are they found in any portion of the cellulares.

2d. *Annular* or *Radiated vessels*, with the aid of a microscope, present an appearance of simple cylindrical tubes, marked with transverse and parallel rays. When seen in the tissues, they look like tracheas which have not been unrolled; they differ, however, in not being capable of unrolling, in not being elastic, by

their rays being parallel and not like spiral, and by being of different diameter to the tracheas when occurring in the same plant. Mirbel considers them to be tubes marked with parallel fissures, whilst others state that they are tubes furnished with opaque parallel rays, which, in their nature, bear an analogy to the punctuations in the dotted vessels. They are generally found in the woody portion of vascular plants, in all the layers of the Dicotyledones, except surrounding the medulla, and in each ligneous filament of the Monocotyledones.

3d. *Punctuated* or *Dotted vessels* assume the appearance of cylindrical tubes, the walls of which are studded with several series of opaque dots. They are most abundant in the Dicotyledones in the woody layers, the root, stem, and branches; and are found in the woody filaments of the Monocotyledones. Kieser considers them as formed by tracheas, or annular vessels, the spires or rays of which are united by a dotted membrane. Mirbel considers them to be perforated tubes; and Dutrochet affirms that they are membranous tubes, marked with dots, produced by prominent vesicles. De Candolle is of opinion that these vessels are membranous tubes, marked with glandular points.

4th. *Beaded vessels* are tubes marked transversely, with spots like the dotted vessels, and contracted at certain spaces, giving the appearance of a string of beads. Mirbel considers them to be cells placed end to end,

with partitions between: these, however, are not found to exist, they may more easily be supposed to be modifications of the radiated vessels. Kieser regards them as spires or rings, considerably separated, but reunited by a dotted membrane. These vessels are common in the root, in the articulations or nodi, and in the commencement of branches and leaves.

- 3d. *Reticular vessels* are the most uncommon of all, and have been less the subject of inquiry. Kieser considers that they are produced by the spiral or annular fibres which form the tracheas and radiated vessels, unequally united together, and leaving between them empty spaces, or oblong holes; they are more common in the root than in the stem.

The vessels are described by some botanists as subservient to the passage of the sap: this opinion, however, is feebly supported, for they are not found to contain any fluid, and moreover, in plants which have no vessels, the sap or juices ascend with as much and perhaps more facility, than in those which are supplied with them. They are now more generally considered to be air tubes, which are in some manner necessary to the vitality of the plant.

Fibres and Layers.

10 If the stem of a vascular plant be cut through, a certain number of hard compact points are seen; and if it be torn longitudinally, these points are found to be sections of longitudinal threads, to which the name of fibre is applied. These fibres are not simple or separate organs, but are composed of bundles of vessels, intermixed with, and surrounded by cellular tissue.

11. When many of these fibres are distributed circularly round an axis, the whole together obtain the appellation of a *stratum*, or layer. The layers are generally concentric rings, or cones, encased one upon the other.

The Cuticle and Epidermis.

12 The term epidermis or cuticle is applied to the thin transparent membrane, which covers the entire surface of plants, except the stigma, and which admits of being separated from the other adjacent tissues with more or less facility. Two opinions have been entertained on its nature: one party considers that it is simple cellular substance, hardened by exposure to the light

and air, and altered by the passage of fluids, and by evaporation. The other party considers that it is a peculiar distinct membrane, which enlarges with the vegetable, like the skin of animals.

The cuticle of leaves appears to be formed by a layer of cells, generally differing in their form from those of the common parenchyma, and which may, in this point of view, be considered a separate membrane, distinct from the subjacent tissues. It is of the same nature in the petioles, young branches, calyxes, corollas, and fruit; and in all parts at their first formation.

73. When a plant is first formed and exposed to the air, its cuticle generally presents all the stomata and hairs it is intended to be supplied with: hence they are thickly arranged, and are separated from each other in proportion as the surface enlarges; and this is a reason why leaves, when expanded, have apparently fewer hairs upon them than in the young state. This, however, in some cases, depends upon the pubescence falling off naturally.

When the young branches have attained their natural dimensions, they cease to be elongated, but begin to be thickened, and at this period the

cuticle assumes a particular appearance. It first becomes opaque, then dries up and exfoliates; or is separated by cracking, caused either by evaporation and the action of the air, or by the distention produced by increase in the diameter of the trunk. About the second or third year its tissue is thickened: it does not present a decidedly areolar appearance. To the external covering when in this state, the term epidermis may be strictly limited.

The epidermis differs from real cuticle in having no stomata, or hairs, such as are abundantly found in the surface of leaves. It serves as a protection to the cellular covering of trunks in various ways. 1st. It diminishes evaporation. 2d. It prevents putrification, which might be produced by external moisture. 3d. It protects the cortex from the effects of frost, by means of its layers retaining a quantity of air between them, and thus offering an impediment to the rapid escape of caloric.

Stomata.

Stomata are orifices very visible by the aid of a microscope, on the cuticle of the greater portion of the herbaceous surfaces of plants. Their

form is oval, sometimes round, and occasionally elongated; their border has an appearance of an oval sphincter, capable of opening and closing itself, and continuous with surrounding cellular structure of the cuticle. Some consider them to be terminations of vessels; others think they communicate with cells; but the most plausible opinion is, that they open into the intercellular passages.

Stomata exist in all the foliaceous surfaces of vascular vegetables, viz. the leaves, stipules, calyxes, and pericarps, which are not fleshy. The parts in which they are not found are the roots, old stems, petioles which are not foliaceous, most petals, fleshy fruits, all the seeds of vascular plants, and all the organs of the cellular plants. They are not found with any regularity as to number or situation; for in some leaves they are seen on the upper surface, in others on the lower, and in some plants on both. Parts, however, which possess most of the characters of the parenchyma of leaves are supplied with them in greatest quantity.

Stomata are likewise wanting in vascular plants which grow under water, in the leafy portion of bulbous plants which is enclosed in the

bulb, and in vascular parasitical plants which are not of a green colour.

Their uses appear to be, to carry off aqueous fluid by a peculiar mode of transpiration, to assist in absorption under certain circumstances, and possibly to absorb air during the night.

Spongiolæ.

Spongiolæ, Spongiolæ, are very small spongy bodies of cellular structure, possessing an amazing power of absorption. De Candolle has described three kinds of them, which are the following.

Radical Spongiolæ, according to some *radical pores*, are found at the extremities of the little fibres of the roots. *Pistillary Spongiolæ* exist in the stigma, and are the means by which the female organ absorbs the fecundating liquid.

Seminal Spongiolæ are found on the surface of the seeds, and are of use in conveying the moisture which causes them to germinate.

The peculiar distinguishing characters of these bodies are the following: they possess greater power of absorption than the rest of the cellular tissue. Absorption takes place in them without

any evident corresponding organization; and they absorb colouring matters which will not enter the stomata, although the openings of the latter are considerably larger.

Little tubercular bodies are found on the surface of the cuscutæ, called haustoriæ or suckers, which are of use in absorbing fluids from the plants upon which they grow. The minute structure of them is unknown.

Lenticels.

Lenticellæ, Lenticels, or Lenticular Glands of some authors, are the little round or oval spots which are observed on the bark of the branches of trees. They are various in their form, size, and elevation, and are found on the bark of most dicotyledonous plants. When roots are given off from branches, they emerge from these places; hence they are considered to be root-buds. They neither absorb fluids, nor assist in evaporation.

Glands.

A gland, according to the present acceptation of the term when applied to botany, is under-

stood to be a secreting organ, the use of which is to extract, from the common nutritious fluid of the plant, a juice of a peculiar nature. The term, however, is adopted too extensively by some authors, and applied to parts totally dissimilar in their properties and uses. There are several kinds of glands, but the following are most evident and most necessary to be enumerated. 18

- 1st. *Glandulæ Urceolares*, or pitcher shaped glands, are fleshy, of a tubercular form, concave, and emit a viscid liquid. They appear to be real excretory glands.
- 2d. *Glandulæ Nectariferæ*; nectariferous glands are organs very various in their shape, and commonly known as nectaries. They secrete a liquid possessing the flavor of honey.
- 3d. Glands found at the base of hairs, as in the nettle.
- 4th. Glands situate at the apex of hairs.

Mirbel has taken a somewhat similar view of them, and from consideration as to their structure, has arranged them in two divisions, the *Cellular* and *Vascular*.

The cellular glands are composed of very fine cellular tissue, and have no communication with the vessels. They produce a peculiar fluid,

whence they may be presumed to be excretory ducts.

The vascular glands are likewise formed by very fine cellular tissue, and are also crossed by vessels in different directions. They do not throw off any particular fluid, hence it is imagined that they prepare juices which are subservient to the uses of the plant.

The Hairs, or Pubescence.

Pili, villi, or hairs, are the soft little threadlike productions found on the surface of plants, and which make them rough and of a downy or velvety appearance. They are elongated glands, and differ from glands only in their form: they vary in shape, uses, origin, and structure. De Candolle makes five varieties of them, viz. Glandular, Lymphatic, such as are attached to the Corolla, Scaly, and Radical.

Glandular hairs are of two kinds: glanduliferi, or such as have a gland at their extremity; and excretorii, which are tubes or continuations of some excretory gland, such are found on the stinging nettle.

In all glands which are supplied with excretory hairs, the liquid secreted is of a caustic irritating nature; and this

liquid, which never escapes naturally, is only directed to the aperture at which it escapes when pressure is applied to the part containing it. This defensive organization bears a strong resemblance to the structure of the fangs of venomous serpents.

Lymphatic hairs, or such as are not united with glands. These are very common, and form the common pubescence of plants. They vary in their direction, being vertical or perpendicular, bent forwards or backwards; and, in their shape, being cylindrical and conical. Lymphatic hairs are not found on roots, or parts excluded from the air; they are sometimes found on young branches and stems, but are most common on the surfaces of leaves, stipules, and calyxes; and particularly on their under surfaces. They are likewise found on peduncles, petioles, and the outside of pericarps. They are most abundant in plants which grow in hot places, and which are dry and exposed to the sun. They are considered by some to facilitate evaporation; but they would rather appear to preserve the plant from too rapid evaporation. They are likewise a protection against cold, external moisture, and the attacks of insects.

Pili Corollini, or hairs of the Corolla, are found on the Petals, Calyx, Stamens, and Styles; on the Corolla of the Cucurbitaceæ; on the Menyanthes, &c. They admit of the same varieties in form as the lymphatic hairs. Their origin and uses are still unknown.

Pili Squamosi, Scaly hairs, are of a dry or scaly nature, and appear like dead substance, possessing no power of absorption. They are found on the Petioles of Ferns, the compound Aigrettes of the Dipsacæ, the appendages to the glumes of grasses, &c. They form what is commonly known as the Pappus, which is of use to convey seeds to distant countries.

Pili Radicales, Hairs, are sometimes found upon the roots, but never in plants which grow in the water. They are supposed to absorb air, and resemble true hairs in their form and structure.

The Articulations and Dehiscences.

The term articulation, in plants, is applied to the points where, at a certain period of vegetable growth, solutions of continuity take place : thus all parts which fall off naturally are supplied with articulations; whereas those which are not, perish at a certain time, are dried up, and fall to pieces, but are never detached in one entire portion.

When an articulation is dissected in the young and fresh plant, we see in it vessels and cells, regular and continuous with those adjacent, but there is observed a prominence or nodosity indicating the point of the articulation. After a

certain time the nodi increase, and a layer of cells and vessels arranged on the same level is dried up and obliterated, and separated from the adjoining ones. The fibres alone, at that time, keep up a communication : these, not being bound and cemented together by the surrounding cellular tissue, are easily torn with the slightest force. The part exposed by the falling off of the dead organ, previously attached by an articulation, is called a *cicatrix*.

The term dehiscence is used in the same sense as articulation, but applied to hollow organs, in which separation takes place longitudinally. Thus most dried fruits, when ripe, open longitudinally or transversely, by one or more regular separations. The places where they take place are generally indicated by rather prominent linear eminences, to which the term *suture* has been affixed. In other cases there is no line or indication of the part to be ruptured, but this takes place in the organ where there is the least resistance. This phenomenon is called dehiscence by rupture.

Division of Vegetables.

Vegetables admit of a division into classes, simply from a consideration of the elementary organs.

In this point of view they may be divided into cellular and vascular; the former solely composed of rounded or elongated cellular tissue; and the latter consisting of cellular tissue and vessels.

21 *Cellulares*, Cellular plants, are constantly without stomata; they present an uniform homogeneous mass, and their organs of nutrition and reproduction are slightly developed. They have besides but a weak tendency to a perpendicular elevation.

22 *Vasculares*, Vascular plants, are generally furnished with stomata; their organs of nutrition and reproduction are well developed, and they have a constant tendency to the vertical direction.

The *Cellulares* are designated also by the terms *Acotyledones*, *Agamiæ*, and *Inembryonataë*; and they form part of the class *Cryptogamia* of Linnæus. The *Vasculares* are synonymous with

the *Phanerogamiæ*, *Phænogamiæ*, and *Embryonataæ*.

Two grand classes may be formed by a division of the vasculares into, 1st, *Monocotyledones* or *Endorhizæ*, and 2d, *Dicotyledones* or *Exorhizæ*. In the first, all the vessels and elongated cells are placed longitudinally, and the new fibres are developed or deposited on the inside of the older or first-formed layers. In the second, the vessels and bundles of elongated cells are situated either longitudinally or transversely, and the woody fibres are formed on the outside of the primary layers or deposits.

The combination or union of the elementary tissues, variously interwoven and blended together, gives rise to the formation of the different distinct organs of a vegetable. The most important of these organs are considered as fundamental, and are the stem, root, and leaves, which are alone necessary for the common support of a plant. These fundamental organs, by being modified in various ways, form the other organs, of which there are two kinds; viz. *reproductive*, or such as are subservient to the repro-

duction of a plant; and *accessory*, or such as give support to the entire plant, or to separate portions of it.

FUNDAMENTAL ORGANS,

OR ORGANS NECESSARY FOR NUTRITION.

THESE parts of the vegetable may be considered as general or common to all species, although, in some instances, they appear imperfect and indistinct. In vascular plants, they consist of the *stem*, *root*, and *leaves*; but in the cellulares they are more or less blended together.

The Stem.

24 The stem is that portion of the plant which extends from the root to the leaves, and has always a tendency to a vertical direction. It is found in all vascular vegetables, but is sometimes so short that botanists have considered it to be wanting, and, in such cases, have named plants *acaules*, or *stemless*. In these, the leaves and flowers seem to emerge from the root, and are called radical, because their bases entirely con-

ceal the stem, from which they are given off. Many plants of this kind, under favorable circumstances, produce stems of a very decided character.

The globular body of the Cyclamens, commonly called a tuberosc root, is a real stem, for it gives off roots from its under surface, and leaves with flowers from its upper one. This opinion is confirmed by its mode of germination, and by its acquiring a green tinge when exposed to the light.

In bulbous plants, the part which may be considered as a stem, consists of that flat rounded portion at the base of the bulb which, on one surface, supports the leaves, on the other, the roots.

Many short and stunted stems are subterraneous, and acquire a great resemblance to roots, for which reason they claim the name of *Rhizoma*, a word which implies a resemblance to a root. Such are found in the European Terns, in the Arums, &c.

The ramifications or divisions of a stem are called *rami*, or branches, to which, taken collectively, the term *cyma*, or head, is applied. Each branch may be considered as a separate

entire individual, grafted on the trunk from which it derives its existence.

The stem at all periods bears the leaves, which will, at an after period, shew themselves; and there are no stems without leaves, excepting in plants, which bear none on any portion of their surface, as in the Orobanches, &c. The stalk of the hyacinth is not a stem, but a peduncle rising from a stem, which is nearly imperceptible.

Hard knotted parts are found on some stems, from space to space, as in the Grasses, and are called nodi; to the spaces between them, the term internodial is given. From these places, in plants possessing them, the leaves generally emerge. They are formed either by a plexus of vessels and fibres, or by a deposit of stoney concretions.

These nodi may by some be readily mistaken for articulations, from which they are readily distinguished. The former are harder and more resisting than the rest of the tissue, whereas the latter are softer, less resisting, and more easily broken.

The duration of stems has given rise to a division of vegetables into annual, biennial, and perennial: annual plants and their stems are

herbaceous; biennial plants die away after the second year; but perennial vegetables live for a considerable number of years.

Other botanists, who have not distinguished stems from a knowledge of their anatomy and functions, have included amongst them parts to which the term is not at present restricted.

They arrange them under five heads.

- 1st. *Truncus*, a Trunk, or woody stem of trees, belonging to the dicotyledones, growing smaller at the top, and dividing into branches.
- 2d. *Stipes*, a Stipe, the fibrous stem of monocotyledonous plants, of equal diameter, or in some cases rather larger at its summit, seldom bearing branches, and generally terminated by a large expansion of leaves. 25
- 3d. *Culmus*, a Culm, or Straw, the knotted stem of grasses. It is generally hollow, and bears leaves, which form sheaths round the stem.
- 4th. *Scapus*, a Scape, or Stalk, a kind of radical peduncle, springing directly from the roots, bearing the flowers, but not the leaves, straight and herbaceous, as in the colchicum autumnale.
- 5th. *Frons*, a Frond, is by some considered as a stem, but requires a separate consideration. The leaves and fructification are found on the same part. The term is now most frequently applied to the expansion of those vegetables, the leaf and stem of which are blended and indistinct, as in the lichens, ferns, &c.

*The Stem of Exogenous or Dicotyledonous
Plants.*

26 The structure of the stem of this division of vegetables is the most complicated, but at the same time its layers are very distinct, so as to admit of easy illustration and description. The order in which the layers are arranged, proceeding from the cuticle to the centre, is as follows: Cuticle, Epidermis, Cortex, Liber, Alburnum, Duramen (or Hardwood), Medullary Sheath, and Medulla or Pith.

The *Cuticle* covers all plants which are woody, extending over the trunk, branches, and roots. It is transparent, and falls off in time, in the form of scales, or in hexagonal masses: it is sometimes covered with a glutinous substance, which assists in preserving the tree. Striking varieties of it are found on the following plants: in the currant and elder tree it is smooth, and scales off in large flakes; it is woolly on the peach, and on the leaves of the willow; and hairy on nettles. It is covered with a resinous exudation on the plum; is sometimes covered with a fungus, forming cork; and contains flint in some instances, as in the *equisetum hyemale*.

The *Herbaceous Envelope*, or cellular substance, called by some Epidermis, analogous to the rete mucosum of the human body, is found external to the cortical layers: its cells are generally rounded and regular, and filled with a greenish resinous matter, which in the leaves fills up the spaces between the ribs, and is then called *Parenchyma*. This membrane is of use in separating transpiratory fluid, and in it the decomposition of carbonic acid takes place. Trees which part with this covering, lose it at a certain regular period.

The *Cortex*, or cortical substance, consists of the layers situated underneath the cellular envelope, and is composed of a network of elongated cells, which are formed by the outer layers of the liber. Its organization is analogous to that of the woody portion, but its layers are formed in an inverse direction. They are fibrous internally, and cellular externally, and are traversed by the medullary rays.

During the first year of growth, a stem has one ligneous, and one cortical layer; in every successive year a new layer of each is formed, on the outside of the woody part, but on the inside of the cortex. The layers of the latter, in course

of time, are dried up and crack, and fall off in detached pieces, seldom presenting a series of accumulated layers representing so many productions of separate years.

The peculiar virtues of most barks reside in the cortex.

29 The *Liber*, which may be considered as a new or young layer of cortex, consists of a vascular network and elongated cellular tissue. Its layers may be separated by maceration, so as to resemble the leaf of a book: and hence its name is derived. This portion of the vegetable is one of the most important, for on it many of the phenomena of vegetation depend. During the season of vegetation, if the cortex be cut through, a thick liquid issues from the incision, and hardens, becoming green, and forming a layer of new bark. The liquid supplied by the liber is called *cambium*. If the circulation be stopped in the stem by a ligature, lumps raise themselves, and a bud is formed in any part where the fluid can most easily find an exit, thus shewing that exogenous stems increase in diameter, by means of the sap flowing downwards.

The *Albumen* and *Duramen* form that firm

30. hard portion of the stem known as the wood. The duramen, which is the deepest-seated central portion, is generally of a deeper colour than the alburnum, and is harder in its texture: its intercellular passages are in a great degree obliterated. They are both composed of radiated and dotted vessels and elongated cellular tissue, and their consistence is produced by a deposit of hard woody particles in the cellular cavities.

The duramen and alburnum are the principal and nearly the sole support of the tree; they serve also as a medium for the fluids to pass up from the roots, through the intercellular passages existing in them.

The *Medullary Sheath* is the woody layer immediately surrounding the medulla or pith. It seems to consist of a cylindrical or angular tube, extending from the top to the bottom of the tree, but, like the pith, branching into as many parts as there are ramifications. Spiral vessels are found in it, at nearly all periods of its existence.

The *Medulla* or *Pith* is a dry light substance composed of cellular tissue, the cells of which are more regular, larger, and more dilated, and of a more spongy nature than in any other part

of a plant. They have external communications by means of the medullary rays, which are composed of cellular tissue elongated in a horizontal direction. The pith is very large in young plants, but in old ones seems to disappear altogether. The uses of the pith are not agreed upon, but De Candolle conceives that it is a reservoir of nourishment for buds, until they expand into leaves, and derive their support from other sources.

The Stem of Endogenous Plants.

These stems are never composed of two distinct substances, like cortical and ligneous, but present a more uniform homogeneous mass: they have no real medullary canal, nor distinct medullary rays: their oldest fibres are found on the circumference or outside, but the newest internally or in the centre, and for this reason they are termed Endogenous, or formed in the centre. The structure of these stems is more simple than that of the Exogenous, but, at the same time, more varied in form and appearance.

The stems of Palms, which, from their general appearance, have been more studied than most other endogenous stems, are composed of fibres

connected by cellular tissue; those in the circumference being firmer, more closely arranged, and older; those in the centre are softer and more distinct, and present rather an herbaceous appearance. Each fibre consists of a bundle of tracheas, radiated and dotted vessels, blended with elongated cellular tissue, and surrounded by rounded cellular substance.

The Culmus, Straw, or Stem of the Gramina, differs from other endogenous stems in this respect, viz. that at the origin or base of each leaf, a *nodus* or knot is found. Between the *nodi* or knots, no leaves, branches, or roots are ever given out; but on the other hand, in the knotted part, the centre, which is occupied by cellular tissue, has the fibres crossing in an horizontal direction: they produce stem-clasping leaves, in the axilla of which, a bud is produced; This, however, is only developed under unusual and very favorable circumstances. From these *nodi*, likewise, adventitious roots are thrown off, when the stems are near the ground or subterraneous.

The Root.

The root is that portion of the vegetable which fixes it to the earth, and is the principal organ of nutrition. Roots generally grow downwards in an opposite direction to the stem, and seek darkness and moisture. They vary in their periods of growth, being annual, biennial, and perennial. It is remarkable in roots that, unlike all other parts of a plant, they never become green when exposed to the action of light and air. Some roots float on the water without ever touching the bottom; others attach themselves to the surface of trees and rocks, from which they absorb the moisture; and there are others which penetrate into the substance of the bark of trees, and are nourished by their sap: plants with such roots are called parasites. Many parts of a plant are capable of producing roots. If a branch of some trees be cut off and placed in the ground, in a short time its lower extremity will be studded with little fibres. Roots are sometimes found at the extremities of leaves, and over the whole extent of some climbing plants, at the nodi of the grasses, and in the axilla of

many aquatic plants. Thus we can account for the benefit derived from rolling the young grass, which, being brought in closer contact with the ground, throws out fresh roots from its nodosities, and in this way forms a new set of plants.

Roots are distinguished from stems by many marked characters: there is a total absence of spiral vessels and stomata. The internal structure of the roots of endogenous plants differs but little from that of their stems, for they are made up of dotted and radiated vessels, intermixed with cellular tissue. The difference between the two, in exogenous plants, is much greater: in the roots there is no medullary canal or pith; the ligneous or woody part is thinner in proportion, but the cellular envelope and cortex are much more developed. Branches are produced from buds, which are productions continuous with the entire bark; whereas roots shoot out without buds, and when they are given off from stems they spring from the lenticels, which never give origin to branches. The branches are generally given out in a regular order, and analogous to that of leaves, but the roots are generally not given out with any determinate precision. There are articulations in the branches,

but none in the roots; and when nodi are found on them, they are very different from the nodosities of stems and branches.

34, The root is commonly described as consisting of three parts, viz. the *Caudex*, body, or middle portion; *Collum*, the neck, or the part which unites it with the stem; and *Radiculæ*, or rootlets, which are the fibrous terminations. The variety in these forms has occasioned an arrangement of them into the following seven classes:

Radix Fibrosa, composed of numerous fibres, as in the *Grasses*.

Radix Repens, a creeping root, as in the *Mentha Pulegium*.

Radix Fusiformis, spindle-shaped, as the *Carrot*.

Radix Præmorsa, an abrupt root, or one which appears as if bitten off, as in the *Scabiosa Succisa*.

Radix Tuberosa, a tuberous or knotted root, as in the *Potato*.

Radix Bulbosa, a bulbous root, a term erroneously employed: however they are described as of three kinds: *Solid*, as in the *Crocus*; *Lamellated*, as in the *Onion*; and *Squamous* or *Scaly*, as in the *Lily*.

Radix Granulata, a granulated root, as in the *Saxifraga granulata*.

The *Rhizoma*, described by some as another

variety of root, is a subterraneous stem, which gives out rootlets from its surface.

The uses of the root are to fix the plant to the ground, and to supply the greater portion of the fluids necessary for its nutrition. The absorption takes place solely by the rootlets, which are terminated by little absorbing bodies called spongioles.

Many tuberous roots afford a supply of nourishment for the plant, in case of accident, when nourishment ceases to reach it, or at the period when the leaves, not being developed, cannot act upon the fluid, as in the early spring time, or, lastly, at the time when the ripening seeds require a superabundance of alimentary matter.

The Leaves.

The leaves are those flat expansions which grow laterally from the stems and branches of plants, and form one of their principal ornaments.

In a physiological point of view, they are the principal organs of evaporation: they decompose carbonic acid gas, and produce changes in the juices, and are consequently the most important agents in nutrition.

Anatomically considered, a leaf is the expansion or unfolding of one or several fibres, which detach themselves from the general mass of the stem, and separate themselves in such a way that each vessel is distinct from the others, and has its proper orifice more or less isolated.

A leaf is generally described as divided into two parts; the flat expanded portion called the *limb*, and its footstalk or *petiole*. The limb is composed of an upper and under surface; the cellular soft substance interposed between them, called *Parenchyma* or *Mesophyllus*, and the ribs or branches from the petiole. The upper is distinguished from the under surface by being smoother; it is of a deeper green colour; its veins are less prominent; it is less pubescent, has fewer or no stomata, and its cuticle is more adherent. The under surface is characterized by opposite qualities: its ribs or veins are prominent, it is considerably pubescent, has numerous stomata, and is of a paler colour, from its cuticle being less adherent. This rule, however, does not apply universally, for, in some water plants, stomata are found only on the upper surface, and in some herbaceous plants, both surfaces are to all appearance exactly similar.

The ribs are little fibrous lines which are given out from the petiole, and ramify through the limb, like the bones of a skeleton. The term veins is sometimes applied to the ribs, if they are but slightly prominent, and little sensible to the touch.

The difference of direction in the distribution of these veins, is a mark of distinction between exogenous and endogenous plants. In the former, they ramify in the parenchyma of the leaf, in no precise order, and form an appearance of network; but in the latter, they run parallel to each other, and are united by separate transverse little branches.

A *petiole* is called simple, when it does not terminate with a tendril, and bears one leaf only. It is called branching, when it terminates in several tendrils; and common, when it serves as the base of insertion to several lesser petioles.

The petiole obtains various epithets from its form and situation. It is called dichotomous, when it divides into two portions; and trichotomous, when it divides into three. The petioles are accompanied also by little appendages called stipules, which partake of the character of leaves.

The leaves are of different kinds in respect

to the period of their growth and importance. They are seminal, primordial, and characteristic.

By *seminal* leaves are understood the cotyledons. *Primordial* leaves (*folia primigenia*,) are the leaves which first appear after the cotyledons, and bear some resemblance to them.

Characteristic leaves are the ordinary leaves of a plant, and, from being generally of definite forms, afford excellent distinctive characters. They are simple and compound. The simple leaf has a single limb, which admits of great variety in its form, surface, and colour.

Compound leaves consist of a number of little leaves, which are attached to one common petiole.

The absorption of fluids and gases by leaves, principally takes place in their under surface. The upper surface, which is more smooth, is a medium for the excretion of useless fluids and gases, and to this function the term transpiration is usually applied.

The decomposition of the *carbonic acid* of the atmosphere principally takes place in the *Parenchyma*; the air penetrates, and combines with the gas contained in the under surface: light decomposes them, fixes the carbon, and disengages the oxygen. The reverse takes place

when plants are kept in the dark. *Leaves* are the principal seat of irritability, which has been proved by various experiments. The *leaflets* of a large number of *leguminous plants* close at the approach of night, and open the following morning, as if refreshed by sleep. The *leaves* of the *Hedysarum gyrans* are subject to a constant movement, which appears to be spontaneous, or independent of external agency.

Leaves generally are annual, but there are some which remain on the plant for a much longer period, even for the space of two or three years.

The provisions made by nature to remedy the injury sustained by a tree from the loss of its leaves, are also subjects worthy of consideration.

If a tree be robbed of its leaves during the season of vegetation, the mischief is partly remedied by the buds, (which were latent in the axilla of the leaves, and which would not have been developed before the following year,) receiving a rapid increase, and forming fresh leaves. If by misfortune this does not take place, the tree generally perishes.

When a plant is naturally without leaves, the use of those organs is supplied, either by ano-

ther organ of the same plant, or by means of another plant.

The absence or diminution of the limb is supplied,

Either by a dilatation of the petiole, by means of which its fibres are more divided, the cellular tissue is expanded, and stomata are exposed: this is generally observed in plants wanting the limb;

Or by an enlargement of the stipules or foliaceous appendages;

Or in plants where the leaf is totally wanting, or falls off prematurely, the parenchyma of the bark of the young branches alone supplies its place; in these cases the cellular envelope is unusually developed, and the stomata are more abundant.

To parasitical plants, where the bark is not changed in its functions, and in which leaves are wanting, or are transformed into scales incapable of the functions of leaves, a power is given of implanting themselves on vegetables supplied with leaves, and of appropriating the sap elaborated by them..

Foliaceous Appendages.

The parts commonly described as leafy appendages, are Stipules, Tendrils, Glands, Thorns, Prickles, and Hairs, or Down.

Stipules are those leafy portions like little

wings, found at the base of the true leaves. They are generally considered as abortive leaves, and, to a certain extent, they enjoy the same functions.

Tendrils, supposed to be abortive petioles, or terminal leaves, are the spiral twisted appendages, such as are found attached to the stalks of the grape vine. Their principal use is to keep the plant in its position, by entwining themselves around some firm adjacent body.

The *Glands* resemble similar organs found on other parts of a plant.

Thorns, found on leaves and some other parts of a vegetable, proceed from the wood itself.

Aculei, Prickles, are productions of the cortical part only, and come away with it. Both these appendages are a considerable protection against the aggressions of animals.

Pili, Hairs, as before mentioned, are organs of absorption or exhalation. In the nettle and some other plants, they are excretory ducts to certain glands, which secrete an acrid irritating fluid.

ORGANS OF REPRODUCTION.

THE organs of reproduction by fecundation, in vegetables, appear only at a certain period of their growth, and are generally known as the flower, with its coverings and contents. The separate portions of these organs are generally considered as seven in number, four of which are proper to the flower, viz. the *Calyx*, *Corolla*, *Stamens*, and *Pistils*; two belong to the perfect fruit, as the *Pericarp* and *Seeds*; and one common to both, viz. the *Receptacle*.

Inflorescence, or the Arrangement of the flowers of Phanerogamous plants.

The term inflorescence is applied to the arrangement of the flowers on the part which bears them, and may be described as of two kinds, the simple and compound.

By simple inflorescence is understood the position or situation of single flowers. They are *cauline*, *foliaceous*, *pedunculate*, *sessile*, *axillary*, *binate*, *ternate*, *alternate*, *scattered*, *opposite*, *erect*, *nodding*, or *pendulous*.

By compound inflorescence is understood the

peculiar arrangement of a number of flowers collected together. The principal varieties may be arranged under the following heads:

1. *Amentum*, a Catkin, is an assemblage of floral scales placed round an axis, which is generally of some length, slender, and dependent. The apex of each scale covers the base of another, and beneath are found the stamens or pistils attached to the base. The catkin may be either male or female. In some works it is described as a variety of *Calyx*.
2. *Spica*, a Spike, is an elongated collection of flowers, either sessile or having short peduncles attached to a common axis, as in the several species of *Veronica*.
3. *Racemus*, a Raceme, or Cluster, is an assemblage of flowers or fruit, rather distant, with longer pedicels than in the spike, connected by a common stalk, as in the *Currant*.
4. *Panicula*, a Panicle, is a loose collection of flowers with long pedicels, somewhat like a bunch or cluster, as in the common *Oat*.
5. *Thyrsus*, a Bunch, is a dense collection of flowers, of a pyramidal form, as in the *Lilac*.
6. *Corymbus*, a Corymb, is a collection of flowers in which the lower partial flowerstalks are long, the upper ones short, so that all the flowers attain about an equal level, as in the *Yarrow*.
7. *Cyma*, a Cyne, is a species of irregular umbel. In it the partial peduncles divide into secondary ones, and

these give out smaller ones, so that all the flowers are nearly on an equal level, as in the *Laurustinus*.

8. *Fasciculus*, a Fascicle, is a close group of straight flowers, of about the same length and size as the *Sweetwilliam*.
9. *Umbella*, an Umbel, or according to some, a compound Umbel, is known by all the peduncles, of equal length and size, arising and diverging from a single point. The peduncles are divided at their extremities into pedicels, which likewise unite at their base. The whole together form a kind of hemisphere, resembling an open umbrella, as in the *Hemlock*.
10. *Verticillus*, a Whorl, is a collection of flowers round the stem, in the form of a ring, as in the *Dead Nettle*.
11. *Capitulum*, a Head or Tuft, is a globular collection of sessile flowers, as in the *Globe Thistle*.
12. *Calathidis*, or *Cephalanthus*, is the name given to the arrangement of compound flowers. They are sessile, on a common receptacle, and are surrounded by a common involucre or calyx.
13. *Strobilus*, a Strobile or Cone, is distinguished by a collection of coriaceous or ligneous scales, of a hard consistence. It is found on the female heads of the *Coniferæ*, and in the *Hop*.
14. *Sertulum*, is a collection of flowers, each on a separate peduncle, and all arising from the same point. An example of it is found in the *Primrose*. This may be considered as a simple Umbel.

The Flower.

The flower is that temporary portion of the vegetable which contains the parts of fructification, with or without, an envelopc. In point of structure, a flower is defined by De Candolle as the assemblage of several whorls of leaves (generally four,) variously transformed, and placed in the form of a terminal bud, at the extremity of a branch called a Pedicel.

A *complete* or *perfect Flower* consists of five parts, which are the *Pistil*, or pointal; the *Stamens*, or chives; the *Corolla*, or blossom; the *Calyx*, or empalement; and the *Receptacle*.

If any of these parts be wanting, the flower is called incomplete. A perfect flower is always hermaphroditic, but imperfect flowers may be female or barren.

Pistil.

The pistil is usually described as divided into three parts, the *Germen*, *Style*, and *Stigma*. The *Germen* is the enlarged base, called ovary; which contains ovula, or embryos of the seed,

and admits of great variety in its form and mode of insertion.

The *Style* is the slender filamentous part situated between the *Germen* and *Stigma*. It is sometimes wanting, and the *stigma* is then called sessile. *Styles* are sometimes very numerous, and vary greatly in their shape.

The *stigma* is the summit of the pistil, generally tumid and gummy, prepared to receive the fertilizing pollen.

The *stigma* has an orifice in its summit, and a cicatrix is always evident in it. It is covered with moisture, to retain and swell the fecundating *pollen*, which possesses a singular property of bursting as soon as it comes in contact with watery fluids. The *Style* is perforated through its centre, to transmit the fertilizing fluid to the *Germen*.

The *Germen*, or *Ovary*, situated beneath the *Style*, contains little ova attached, by an *Umbilical Cord*, to a *Placenta*. The pistil is described by most modern botanists as being a modification of one or more leaves, called *Carpels*, the under surface of which forms the outside of the ovarium, the upper surface forms the inside, and the margins give rise to the ovula or seeds.

The *Pistil* is composed of *Air Cells*, porous vessels, and elongated cellular tissue. The vessels of the parent plant enter into it freely, and convey to it nourishing juices.

By excess of nourishment, a *Pistil* may be metamorphosed into a *Petaloid* expansion, and consequently become barren.

Stamens.

The *Stamens* consist of a *Filament*, and a head called *Anther*. They arise from the Receptacle, and are generally arranged with great regularity.

The *Filament* is the part formed like a little pedicel, which bears the anther. It is in substance like the Petals, and when articulated upon the Receptacle it falls off after fecundation, but if not, it dries up without falling, as in the *Campanula*.

The *Anther* is the little sac, which surmounts the filament, and is generally full of a yellow dust, called *pollen*; it most frequently consists of two bags united together: this point of union is called connectivum.

The *Pollen* is composed of a little membrane, forming a kind of bladder, and filled with the

fecundating fluid: these portions of *Pollen* are so small that they look like particles of fine dust. If one of them be placed on some water, it swells, bursts, and throws out a liquid matter, called the *fovilla*, somewhat resembling oil in its properties.

The *Filament* is of the same substance as the *Corolla*; sometimes it is hollow; at other times it is filled with air-vessels. Its only use is to support the *Anther*, and to retain it in the position most favorable for the performance of its functions.

Corolla.

The internal envelope of the flower is called the *corolla*, and the same term is used when there is but one floral envelope, and it is coloured and unlike the leaves.

The corolla is called *hypogynous* when it is inserted beneath the germen, *perigynous* when it is inserted into the internal walls of the calyx, and *epigynous* when it is inserted into the summit of the germen. If the corolla is formed of one undivided piece only, it is called *monopetalous*; if it consists of several, it is called *polypetalous*. The corolla admits of great variety in

its form. Its varieties may be arranged in the following order :

1. *Regular Monopetalous Corollas* are *Funnel-shaped*, *Bell-shaped*, *Globular*, *Bowl-shaped*, *Wheel-shaped*, and *Star-shaped*.

The general parts of a monopetalous corolla are the tube, throat, and limb.

The *Tube* is the lower portion, and is always straight; its orifice is called the *Throat*. The upper expanded part is called the *Limb*.

2. *Irregular Monopetalous Corollas* have the limb divided into two unequal parts: they are named *Ringent* and *Personate* Flowers.

Ringent Flowers always contain naked seeds, which are found at the bottom of the cup.

The seeds of *Personate Flowers* are always contained in a capsule.

3. *Anomalous Monopetalous Corollas* are those which cannot be referred to either of the above heads.

4. *Regular Polypetalous Corollas* have several petals of the same length and size, as in the cruciform and rosaceous flowers.

The petal of a polypetalous corolla consists of two parts: the lower thin part is called *Unguis*, or claw; and the expanded portion *Lamina*, or border.

The petals in general are of the same number as the Sepals, or divisions of the Calyx, and are not placed opposite to them, but in the intermediate spaces.

5. *Irregular Polypetalous Corollas* are of two kinds, the papilionaceous and orchidean.

The *Papilionaceous* corolla is composed of five petals, which have received different names.

The upper one is called *Vexillum*, or *Standard*; those on the sides are named *Alæ*, or *Wings*, and the lower ones, generally united, form the *Keel*, or *Carina*.

The corolla of plants of the orchis tribe is composed of six petals, five superior and one inferior.

6. *Anomalous Polypetalous Corollas* are formed of numerous irregular petals, which cannot be referred to either of the above descriptions. Such are those of the *Violet*, *Larkspur*, and *Aconite*.

The *corolla* is said to be a continuation of the ligneous substance situated under the bark: it is formed principally of cellular tissue and vessels, and has seldom any glands. Both in light and darkness it exhales carbonic acid gas and never oxygen: hence its deleterious properties. It immediately encloses and protects the fecundating organs.

The term *corolla* has been abolished by some botanists, and this alteration has given rise occasionally to much inconvenience; for one will be describing a *corolla* of a plant very minutely, whilst another botanist describing the same, states that it is deficient. It should be recol-

lected that Monsieur Jussieu always uses the term calyx superior, for corolla.

Calyx.

The flowercup, or external covering of the flower, is generally of the texture of the leaves. Its divisions are by some called *Sepals*, by others *Phylli*, or leaves, and hence the terms *Mono-phyllous*, *Polysepalous*, &c. Calyxes have been classed in the following manner :

1. *Perianthium*, a perianth, the most common and general form of calyx is contiguous to, and forms part of the flower, as is seen in those green leafy parts which surround the *rose*. *Tulips* have no calyx at all. There are plants which have a double perianth, as the *marsh mallow*.
2. *Involutrum*, the involucre, consists of those little leaves which surround the base of the peduncles of umbelliferous plants.
3. *Spatha*, a sheath, is a covering which bursts longitudinally, as in the *snowdrop*.
4. *Gluma*, a husk, is of a chaffy texture, and is found principally on grasses. The *husk* gives out an appendage, called *arista*, or *awn*, which is usually spiral.
5. *Volva*, a wrapper, is a covering of the parts of fructification of some species of the fungus tribe. It forms a ring upon the stalk, as in the *agaricus procerus*.

The *Calyx* is an expansion or elongation of the *bark*, which it resembles in colour and consistence. It generally contains air-cells, and its cuticle is studded with little glands. It absorbs carbon, like the leaves, when exposed to the sun, and gives out carbonic acid in the shade, and affords a protection to the other parts of the flower against the severities of the air; it also elaborates juices for the supply of the flower and fruit.

Pedicel and Peduncle.

The peduncle, or flower-stalk, is a ramification of the stem which bears the flowers, but not the leaves; its subdivisions are called pedicels, each of which supports a single flower. These parts are, in many cases, so extremely short, that the flowers are on that account called sessile.

Peduncles are generally round in shape, but by pressure become flattened and angular. They often become enlarged in their extremity, when they give insertion to a collection of sessile flowers, and to this enlarged part the term *Climanthium* is applied.

Both pedicels and peduncles are often united to the plant by articulations.

Receptacle.

The *receptacle* is that portion of the vegetable which serves as a basis of insertion to the parts of fructification; or it may be considered an expansion of the pedicel which produces the stamens, petals, nectaries, and any other lamelated formations. It has obtained various names from different authors, being called *Torus*, *Thalamus*, or *Discus*.

The *Spadix* is considered as a form of receptacle: it is covered and surrounded by a membranous envelope, called *spatha*, and serves as a peduncle to a considerable number of flowers.

Floral Appendages.

The parts called floral appendages are the proper *nectaries*, the *spur*, *crown*, and *scales*. All these were formerly called nectaries indiscriminately, till further discoveries pointed out the difference between them.

Nectaries are those glandular bodies which are found situated on the receptacle, germen, or corolla, and secrete particular juices resembling honey.

Calcar, the spur, is a horn-shaped elongation of the

floral integuments, which is generally extended by the side of the pedicel.

Corona vel Scyphus, the crown, is a cup-like portion, resembling the true corolla, as is seen in the centre of the *Narcissus*.

A variety of them is found in *Hellebore*, *Passion flower*, and *Mosses*.

Squama, a scale, includes any other small appendage of a flower, not entering under the denomination of those already mentioned.

Fruit.

The fruit consists of the union of several perfect mature germens, and is the sole object, and result of fecundation; it is defined by others as the pistil in a state of maturation. The fruit is composed of two parts, the *pericarp* and the *seed*.

The Pericarp is divided into three portions; the external one called Epicarp, the inner one Endocarp, and one between them named Sarcocarp. In many instances they are distinct and easily separated, but in others intimately blended together.

The pericarp exists in all seeds, although, from its extreme thinness, and close adhesion, it

occasionally appears to be entirely wanting. The most elevated point of the pericarp generally presents an indication of the remains of the style or stigma, and to this part the term *apex* is applied. The *base* is the spot where it is attached to the pedicel or peduncle, and its axis is represented either by a central pillar, or, in some cases only, by an imaginary line drawn from the base to the apex.

The *Epicarp*, which is analogous to an epidermis, is said to correspond with the under surface of a leaf.

The *Sarcocarp*, or *Mesocarp*, is the parenchymatous portion, and in it all the vessels of the fruit are concentrated.

The *Endocarp* is considered as formed by the upper surface of a metamorphosed leaf. It is generally thin and membranous; sometimes it appears to be thickened externally by a portion of the sarcocarp. When this part of the sarcocarp becomes hard and woody, it encloses the seed, and forms what is known as a nut.

The cavity of the pericarp may be single, or divided into numerous separate cells; in the former case it is called one-celled, or unilocular; in the latter, many-celled, in accordance with the number of the partial cavities.

The cells of the pericarp are separated by

vertical membranous layers, or plates, called *dissepiments*.

The part where the pericarp unites with the seed, is called the *umbilicus*, or *hilum*, and this is considered as the precise boundary between the seed and the pericarp.

The seeds are attached to the inside of the pericarp by a certain fleshy portion, various in form and size, named *trophosperm*, or *placenta*, which traverses the endocarp to receive its vessels from the sarcocarp, or parenchymatous substance. The placenta sometimes gives out several elongations, like pedicels, each supporting a seed, and to these little bodies we apply the term *podosperm*.

When the *trophosperm*, or *podosperm*, extend beyond the hilum of the seed, so as to cover a portion of it, the extended portion is called an *arillus*, a familiar illustration of which is found in the mace surrounding the nutmeg.

As the seeds are enclosed in the pericarp, it is a necessary consequence, at the period of their maturity, that the pericarp should open in some particular manner, to allow their exit. The natural act of opening in the pericarp is called *dehiscence*. Pericarps which do not open spon-

taneously are called *indehiscent*. The separate parts of a dehiscent pericarp are called valves, which vary greatly in number in different plants. The line indicating the point of their separation is named a *suture*.

There are little bodies attached to some pericarps, which may be called appendages, and are very varied in their appearance. Thus, in the pear and apple, it is surmounted by the teeth of the calyx. In some plants it is crowned by a silken feathery substance, called *pappus*, which may also be esteemed a calyx. This pappus is of great use in botanical classification, as it affords excellent distinctive characters. Its use is that of assisting, by its lightness, in the conveyance of the seed to distant parts by the agency of the wind.

Another form of appendage is that of membranous expansions, like wings, as in the elm and maple. The number of these also gives the terms *dipterus*, *tripterus*, &c. In some cases the pericarp is covered with long stiff hairs, or with thorns, as on the *chesnut*, and *thorn-apple*.

The Seed.

The seed is contained in the pericarp, and encloses the rudiment of a new vegetable. There are no seeds which are naked, that is, not covered by a pericarp, although the latter is sometimes so extremely thin and adherent as not to allow of distinction or separation.

Every seed is formed by a fecundated ovulum. The character of a seed is this: it contains an organised body, which, under favorable circumstances, is developed and forms an individual precisely similar to the one from which it derived its existence.

The seed is composed of two parts, the *Kernel* and its covering, the *Episperm*.

The point where the seed is joined to the Pericarp is called the Hilum or Umbilicus, through which the vessels pass from the trophosperm to the proper integument of the seed.

The centre of the Hilum represents the *base* of the seed; its apex is the point diametrically opposite.

Seeds differ considerably in respect to their direction relatively to the axis of the Pericarp.

Thus they are said to be *erect, inverted, ascending, suspended, &c.*

The Episperm surrounding the seed is generally simple and uniform. It is sometimes of some thickness, presenting a fleshy appearance, and admitting of a separation into two layers; the outer one called *Testa*, the inner one *Tegmen*: these may be easily seen in the seed of the Ricinus.

The *Hilum* is always situated on the episperm. It is generally small, but in some cases of considerable size. The whitest portion seen on the chesnut is all Hilum. Towards the centre or sides of the Hilum is seen a very small aperture, termed by M. Jussieu *omphalode*, by others *micropyle*: it is considered as affording passage for the vessels from the trophosperm to the episperm. When the plexus of vessels runs along the episperm for some little distance, it forms a prominent part, called the *Raphe*, or *Vasiduct*: the inner point of its termination is called the *Chalaza*, or internal umbilicus.

The *Kernel* comprises the whole of the seed contained within the episperm. It is sometimes formed exclusively by the embryo, but in other cases there is superadded the *Endosperm*, called by different authors *Perisperm*, or *Albumen*.

The *Endosperm* is a mass of cellular tissue enclosing fæcula of starch or mucilage. It is either hard like horn, or fleshy and soft, and, during germination, undergoes a gradual decrease. It surrounds the embryo, with which there is no vascular communication, but during germination it affords a great supply of nourishment. Its colour is generally white, but its substance is very variable. It is dry and farinaceous in corn, oily and fleshy in the seeds of the *Ricinus*, and of a horny consistence in the Coffee. Its presence or absence is of some importance in tracing distinctions of the genera.

The Embryo.

The *embryo*, or rudiment of a new plant, is enclosed within the episperm, and may be invested by endosperm, as in the *Ricinus*, or unaccompanied by it, as in the bean.

The parts forming the embryo are the *Radicle*, *Cotyledons*, *Plumula*, and *Collum*, or neck.

The *Rootlet*, or radicle, is one of the extremities of the embryo, which, after germination, becomes the root, or gives rise to its formation. It is not always recognised with facility, but is very evident as soon as germination commences. It has an invariable tendency to seek the centre of the earth, whatever be the obstacles opposed

to it. In some plants, by its simple elongation, it is transformed into the root: this is observed in most of the dicotyledones. Plants having the radicle external and uncovered, are called *Exorhizæ*. In other plants, on the contrary, the rootlet is covered and hidden by a peculiar envelope, which bursts at the period of germination; this envelope is called a *Coleorhiza*, and the plants possessing it *Endorhizæ*, which include most of the monocotyledones. In some rare instances the rootlet appears to be intimately united with the endosperm: plants with this arrangement are called *Synorhizæ*.

The *cotyledonous* substance may be single and undivided, and in such a case is composed of one cotyledon, giving to plants the character *monocotyledones*: plants possessing two or more are called *dicotyledones*. The cotyledons appear to be intended to assist in the development of the young plant, by supplying it with materials fit for its nutrition. They are thick and fleshy in plants wanting the albumen, but in those possessing it, they are thin and foliaceous. At the time of germination some cotyledons remain concealed in the ground, and are called *hypogeal*. When they emerge from it they are said to be *epigeal*, and then form the (*folia seminalia*) seminal leaves.

The *Plumelet* (Gemmule of Richard,) is the little body which springs upwards from between the cotyledons, or from the cotyledonous centre, if it be single. It may be considered as the first bud of the plant,

the first leaves of which when expanded are called *primordial*.

The *Collum*, or neck, is the point of union between the radicle and plumelet.

The embryos of monocotyledons and dicotyledons differ very considerably in appearance. The *Dicotyledonous Embryo* presents the following characters: the Radicle is cylindrical or conical, naked, and projecting, and forms by germination the root of the plant. Its two cotyledons are on an equal level on the little stem, and are generally very thick, if the albumen be scanty or deficient. The plumelet is enclosed between the cotyledons, which conceal it entirely or in great part.

In the *Monocotyledonous Embryo*, the cotyledon, before germination, was perfectly indivisible, presenting neither cleft nor incision. The separate parts of these embryos are not easily distinguished in all cases, for they are sometimes so united and blended together as to appear one homogeneous mass. Hence their organization is less known than that of vegetables, which have two cotyledons. The radicular body occupies one of its extremities; it is rounded,

but slightly projecting, forming a kind of mamillary protuberance: however it is very large, in some instances, and forms the largest portion of the embryo, as in most of the gramina.

The rootlet is enclosed in a *Coleorhiza*, which it bursts at the period of germination. It is sometimes composed of several fibres, each of which, in some instances, pierces the *Coleorhiza* separately.

The cotyledonous substance is single, but its form is extremely variable. It is always lateral, in relation to the embryo. The plumelet is generally enclosed in the centre of the cotyledon, which surrounds it on all sides: it is composed of small leaves encased the one within the other: the external portion of which is named by Mirbel *Pileolus*. The plumelet is sometimes covered, like the root, by a substance which it bursts, called a *Coleoptile*.

Classification of Fruits.

The seed vessels of separate plants differ not only in form, but likewise in the relative proportion and arrangement of the individual parts.

The varieties of fruit are classified in many different ways by botanists, and have each re-

ceived a separate name. A simple and general division of them may be made into *simple*, *multiple*, and *compound*.

The *Simple* fruit is produced from a single Pistil, contained in a flower, as in the *Cherry* and *Peach*.

The *Multiple* fruit is produced by several pistils, contained within one flower, as in the *Strawberry* and *Raspberry*.

The *Compound* fruit results from the union of a number of pistils, sometimes consolidated together, but all arising from distinct flowers, which were very closely approximated, as in the *Mulberry*.

They are divided into *dry* and *fleshy*, on account of the character of their Pericarp.

The most simple outline of arrangement of them is the following:

CLASS I. Simple Fruits	{	Dry	{ Indehiscent.
			{ Dehiscent
			{ Fleshy, Indehiscent.

CLASS II. Multiple.

CLASS III. Compound.

Simple, Dry, and Indehiscent Fruits.

Fruits of this class are generally oligosperm; that is to say, they contain few seeds. Their

pericarp is generally thin, and sometimes so closely united with the proper integuments of the seeds as to appear as if wanting, and giving rise to the error of seeds ever being naked, or without a pericarp.

1. The *Caryopsis*, is one-seeded and indehiscent. The pericarp is so thin, and so intimately blended with the seed-coats as not to admit of separation. Its form varies considerably. We have examples of it in wheat, barley, Indian corn, &c.
2. The *Akenium*, is one-seeded, indehiscent, with its pericarp distinct from the seed, as in the *Synantheræ*, the *sunflower*, &c.

It has often appendages attached to it, as the *pappus*, &c.

3. The *Polakenium* is a single fruit, which, when ripe, is separated into two or more cells, each of which may be regarded as an akenium. Such are found on the *umbelliferæ*.
4. The *Samara*, is coriaceous, membranous, and flattened, having generally two cells, which send out lateral elongations, or enlarged appendages, called *alæ*, as in the maple and elm.
5. *Glans*, a gland, or nut, is generally one-celled, and indehiscent: its pericarp is closely united with the seed, and it is, in great part, surrounded by a scaly or leafy involucre, called a *cupule*, as in the nut or acorn.

Simple, Dry, and Dehiscent Fruits.

These are generally many seeded: the number of their valves and cells is very variable. They are, in general terms, designated capsular.

1. *Folliculus*, a follicle, is generally membranous, one-celled, and one-valved, opening by a longitudinal suture, to which is attached the trophosperm, generally supporting the seeds on one side of the suture only.
2. *Siliqua*, a pod, is elongated, bivalve, with the seeds attached to two sutural trophosperms. It is sometimes separated into two cells, by a partial partition parallel with the valves. This partition is formed by an elongation of the trophosperms, as in the cruciferæ.
3. *Silicula*, a silicle differs very little from the siliqua. It is shorter in proportion to its breadth, and has fewer seeds. It likewise belongs to the cruciferæ.
4. *Legumen*, a legume, is dry, and bivalve. Its seeds are attached to a single trophosperm, which follows the direction of one of the sutures only, as in the leguminosæ.

There is great variety in the legume; it is naturally one-celled, but there is occasionally a partial septum, dividing it into two or more cells, as in the astragalus. In the *Cassia*, it is separated into numerous cells, by transverse septa.

Sometimes it seems as if formed by separate portions,

articulated together, as in the *lomentaceæ*. It is occasionally swelled out, as if inflated, and has thin transparent parietes, as in the *Colutea*. The seeds vary considerably in number. There are some legumes which contain but one.

5. The *Pyxidium* is capsular, generally globular, and opening by a transverse fissure into two hemispherical valves, as in the *Hyoscyamus*.
6. The *Coccum*, or *Elatarium*, has generally its sides or divisions raised, and elastic: it bursts longitudinally, and is then divided into so many cells. Hence the terms *bicoccus*, *tricoccus*.
7. *Capsula*, a capsule may be considered to be any dry dehiscent fruit, not comprised under the previous heads. Hence great variety in them may be anticipated. Thus there are some which open by pores in their upper part, as in the poppies; others open by their base. Many are dehiscent only at their summit, which, before ripening, was closed by little teeth closely arranged.

Fleshy Fruits.

Fleshy fruits are indehiscent; they are thick and pulpy, and the number of their seeds is very variable.

1. *Druva*, a drupe. is a fleshy fruit, enclosing a stone,

which is formed by the hardening of the endocarp, and portion of the sarcocarp, as in the peach, cherry, &c.

2. *Nux*, a nut, differs from the drupe only in having a thinner pericarp, as in the almond and walnut.
3. *Pomum*, a pome, (Melonide of Richard,) is a fleshy fruit arising from numerous parietal ovaries, united and consolidated with the calyx, as in the *apple* and *pear*.

The endocarp lining each cell of a pome, is said to be cartilaginous or bony. It is cartilaginous in the *apple*, and bony in the *blackthorn* and *medlar*.

The pome belongs exclusively to the *rosaceæ*, all of which bear either this precise form of fruit, or one closely resembling it.

4. *Pepo*, a gourd, is a fleshy fruit, with numerous cells distributed in the pulp, each containing a seed which is firmly united with its inner coat, so as to be separated with the greatest difficulty, as in the *melon*.
5. The *Hesperidium* is a fleshy fruit, with a thick envelope, divided internally into many cells by membranous septa, which may be separated without laceration, as in the *lemon*, &c.
6. *Bacca*, a berry, is a term applied to all fleshy fruits deprived of a stone, which do not enter under the above-named species, as *grapes*, *gooseberries*, &c.

Multiple Fruits.

Multiple fruits are produced by the union of numerous pistils contained in one flower; and generally obtain the name of Syncarpium.

The raspberry and strawberry are formed by a number of little drupes, (the sarcocarp of which is rather thin, but very evident in the strawberry,) united together upon a fleshy gynophore.

Compound Fruits.

Compound fruits are formed by the union of several separate fruits closely approximated, and united together, but all produced by separate flowers.

1. *Conus* vel *Strobilus*, the cone or strobile is composed of a number of membranous capsules, situated under imbricated scales, which were as bracteas to the flower, inserted upon a common axis, and assuming the form of a cone.
2. *Syconium* is the name applied, by Mirbel, to the fruit of the fig tree, and contrajerva. It is formed by a monophyllous involucre which is fleshy internally,

either flattened, or oval and closed, containing numerous drupes, each the product of a separate flower.

Buds.

Buds or gems are protuberances which shoot forth from various parts of a plant, as the stem and branches; and contain the rudiments of leaves, flowers, and their supports. The arrangement of the leaves in buds is called vernation, that of the flowers estivation, and, from the protection they afford to the embryo in cold weather, the buds themselves are called hybernacles. Buds are of three kinds, *leaf buds*, *flower buds*, and *mixed* or *compound*, that is, containing rudiments both of leaves and flowers.

Flower buds enclose a flower without leaves, and are generally round and conical. Leaf buds contain leaves only, and are smaller and more pointed, as may be seen on the daphne mezereum.

The mixed or compound buds contain both flowers and leaves, as on the lilac.

Buds generally shoot out at the angle formed by the leaves and the stem, called the axilla, and contain a process, or elongation of the *Pith*.

Nature has covered them with various substances for their protection, such as Scales, and wooly or glutinous substances, which are more observable in cold climates, and wanting altogether on plants in hot countries.

The bud when developed is called a Shoot.

All shoots of vegetables have a tendency to turn towards the light, for if they are placed in a dark room where there is a single aperture, they will generally grow towards it. This fact has been made the subject of some pretty and ingenious experiments.

Bulbs, as *Onions*, have, for a long time, been confounded with *Roots*, and are still considered so by a great number of botanists, though they are, in point of fact, nothing but buds, their scales being only subterraneous leaves.

Cauline Bulbs differ from common bulbs in being produced on different parts of a plant, as at the junction of the leaves, and the bifurcation of the branches; vegetables producing them are called viviparous. Bulbs differ from buds only in the property of throwing out roots into the earth, and in deriving the nourishment in a different manner. They for the most part belong to monocótyledonous plants.

Tuberous Roots, or Tubercles, are pulpy fleshy receptacles which throw out shoots and roots: they differ from *Bulbs* in producing buds at different parts of their surface: a familiar example may be found in the Potato.

CRYPTOGAMOUS PLANTS.

Cryptogamous Plants require a separate consideration; for the description of the various parts of Phanerogamous plants affords little assistance in distinguishing and examining the twenty-fourth class of the Sexual System of Linnæus.

These plants may be divided into five distinct orders, viz. *Filices*, *Ferns*; *Musci*, *Mosses*; *Hepaticæ*, *Liverworts*; *Algæ*, *Flags*; *Fungi*, *Funguses*.

Ferns.

Their root is fibrous, and proceeds from a *Tuber*, or knotted portion, from which also the fronds arise. The tuber is protected by a covering of soft scales.

The plant itself consists of a stalk, and its

leafy expansion called frond, which admits of great variety in its shape and size, growing from the length of an inch to several feet.

The stem varies as to its surface, being polished, scaly, or channelled; and its structure much resembles that of annual stalks in general. Ferns may be propagated by seeds. Their fructification is only manifest in those rounded or spotted little granular excreseences which are observed on the undersurface of the leaves or frond. They are called thecæ, and contain little reproductive bodies called *sporules*.

Mosses.

Mosses are composed of elongated Cellular Tissue, no vessels being admitted to exist in them. The mosses have fibrous roots, which possess great power of multiplying themselves; they are produced, in some instances, from the stem; in others, from any part of the leaf; and are generally terminated by a spongy substance. The mosses have also stems and leaves, which are always sessile; the leaves are thickly set with pores, which supply them amply with moisture, and render them very tenacious of life, for

they will revive after being apparently dead, and dried up.

The parts of fructification are very indistinct.

There are little bodies of various shapes on the stem, which are considered to be *anthers* and *pistils*. Notwithstanding the uncertainty as to this point, the calyptræ or thecæ contain a dust, which has been sown, and known to grow.

Mosses grow best in cold or temperate climates, and derive their chief subsistence from the air.

Liverworts.

These vegetables form a connecting link between mosses and flags; their structure is the same, for they have no vessels, or stomata: they grow on rocks, and are generally attached to the spot by the under surface of the *frond*. Their roots are less numerous than those of the mosses, but they are propagated, like them, by sporules, which are enclosed in membranous cases called *scutellæ*.

Flags.

The Algæ are plants in which the root, stem, and leaves seem blended together; some lichens

form exceptions, in throwing out little roots. Algæ have been properly arranged in six divisions, differing from each other in form, properties, and habit; they are *Lichens*, *Byssi*, *Confervæ*, *Ulvæ*, *Fuci*, and *Tremellæ*.

1. *Lichenes*, Lichens, are a numerous tribe. They grow in all climates, and in most situations, and, in various instances, possess some of the chemical properties of the body on which they grow. They produce gems, by which they are propagated.
2. *Byssi* exist in the forms of the most delicate downy substance, which is found on old wood, in moist situations.
3. *Confervæ* are all aquatic, and grow in the form of green filaments, branching in every direction: their structure is too indistinct to lead to any conclusion as to their fructification or organization.
4. *Ulvæ* are aquatic, of various forms, but always gelatinous: their soft nature precludes a possibility of examining them.
5. *Fuci* comprehend the various vegetables commonly called Sea-weeds: they vary greatly in their form, substance, and organization.
6. *Tremellæ* appear on rotten wood, grass, and in moist weather, like masses of jelly: their organization has never been ascertained.

Fungi.

Fungi are, after the Tremellæ, the lowest order of the vegetable creation.

They are of a fleshy texture, and their most common form is that of a thick frond, having its under surface furnished with laminæ, like the gills of a fish, as in the *Agaricus*; or with deep perforations like a honeycomb, as in the *Boletus*; or in that of a ball, as the *Lycoperdon*.

The parts of a Fungus are,

The *Root*, which generally is in the form of white fibres.

The *Stem*, *Stipes*, is common to several species, and is surmounted by the Cap. Some are destitute of stems altogether.

The *Cap*, *Pileus*, is only found on those fungi which possess the stipes.

The *Veil*, *Calyptra*, is a membranous expansion, which connects the external margin of the circumference of the *Cap* to the *Stipes*. At the mature state of the plant it bursts.

Volva, the *Wrapper*, encloses the entire parts of the frond in some species, at an early period of their growth.

Funguses are supposed to be propagated by sporules, enclosed in little cases called *hymenia*.

Germination.

By Germination is understood the evolution of a plant from a perfect seed, and its duration extends to the period when the cotyledons are absorbed or dried up. If a seed be placed in the ground, or in a situation and circumstances favorable to its vegetation, the embryo swells, cracks, and separates its envelope, and becomes plantula, a young plant. The developed embryo consists of the blastema and cotyledons. The blastema is divided into the collum, plumula, and radicula. The cotyledons are the parts first observed when seeds begin to vegetate; their presence or absence is the most important question connected with them. Plants that are formed without apparent cotyledons are called acotyledonous; those with one cotyledon, monocotyledonous; those with two, dicotyledonous; and those with three, or more, polycotyledonous.

The cotyledon of monocotyledonous plants does not emerge from the root, which has given rise to the erroneous supposition of such plants wanting them altogether.

The cotyledons vary in their substance, size,

arrangement, form, surface, margin, and insertion.

Cotyledons that remain underground during germination are said to be hypogeal, and those that shew themselves above-ground are called epigeal.

Collum, the neck, is the portion of the young plant situated between the plumule and radicle.

The plumula is that portion of the embryo which afterwards forms the stem and leaves, and supplies all the parts which proceed upwards from the root. A little stem and leaves are observed on it; the leaves which are first formed are called primordial, and generally differ from the subsequent ones. Radicula, the radicle, or infant root, is distinguished by the characters of roots in general.

In order that germination may take place, it is requisite that a seed contain all the essential parts, and possess vitality. Some seeds perish from being too long kept without sowing, dying at the end of two years, whilst there are others may be kept in a similar manner for many years, even to the extent of a century.

The external agents of *Germination* are water, heat, and air.

If a *Seed* be placed in favorable circumstances, the moisture penetrates internally through the *Hilum*, swells out the young plant, moistens the seed-coats, and facilitates the rupture of the envelope, by rendering it softer.

Heat acts as a stimulant, and must not be applied either in too great or diminished a degree. Air is so necessary to *germination* that seeds will not grow in an exhausted receiver; and no gas is so congenial as the mixed proportions of the gases which compose the air of the atmosphere.

The chemical changes which take place during *germination* next require consideration. The *Oxygen* of the air insinuates itself with the moisture into the embryo; a quantity of water penetrating gives rise to saccharine fermentation, which is changed to spirituous fermentation by means of the air. The elementary component parts of the farinaceous *Perisperm*, or *Albumen*, are *Oxygen*, *Hydrogen*, and *Carbon*; and the same principles are contained in the fæcula of all vegetables. The access of *Oxygen* destroys the equilibrium, and combines with the *Carbon*: the *Oxygen* of the fæcula thus predominating, a new arrangement of the elements takes place,

and the farinaceous *Perisperm* is changed to a state of soluble sugar.

The saccharine matter enclosed in the cotyledons escapes from them by means of vessels which convey it to the young plant, which is stimulated and awakened as it were into a new life. All these phenomena indicate a spirituous fermentation, for a seed will not putrify, unless an excess of water arrests its evolution. At this period of vegetable growth, the embryo evolves the *Plantula*, or young plant, consisting of the *ascending Caudex*, or *Plumulet*, and the *descending Caudex*, or *Radicle*.

The cotyledons continue to supply the embryo with nourishment, until the little root acquires sufficient vigour for that purpose. The root soon throws out ramifications, which are terminated by spongy bodies, to absorb the fluids from the earth, or from substances capable of supplying them with nourishment. The cotyledons being exhausted, become useless, dry up, and fall off.

At the same time that the juices are being absorbed by the roots, another change is going on in the leaves. The spirituous fermentation stops, on account of the carbonic acid gas, and the water, being decomposed, and no longer afford-

ing saccharine matter, the carbon, which had hitherto been rejected, combines with the elements of the water, and the substances mixed with it. This new combination forms woody, oily, and resinous substances, and the proper juices of plants. The phenomena which commence at this period continue till the death of the vegetable.

Light is so essential to plants, that to it they owe the solidity of their structure, their colour, and the peculiar condition of the proper juices.

Every plant which grows in the dark will be deprived of these qualities, whilst the seed, on the contrary, would be injured by exposure.

All seeds grow in accordance with the physical laws just described, but vary in the mode of evolution; some, for instance, begin to grow before they are separated from the parent plant, thus deriving the necessary moisture from a very different source.

On Vegetable Life.

Vegetable Life consists in the power which resists, for a longer or shorter space of time, the laws of chemical affinity and gravitation. The causes are totally unknown.

The vital phenomena consist in irritability, nutrition, and propagation.

Nutrition is that property by means of which plants develop themselves, increase, and acquire their ultimate dimensions.

The phenomena connected with nutrition are irritability, absorption, circulation, and excretion.

Plants are sensible of the action of stimulants, for hæmorrhage may be stopped in the same manner as that adopted, for a similar occurrence, in an animal. Contraction is the first cause of the spontaneous motion in plants, excited either by external or internal agents. There are various ways in which the irritability of plants is manifested.

Many plants afford a phenomenon of irritability to which Linnæus has given the appellation of sleep. At the approach of night, they alter their direction, and resume their daily position in the morning.

The Sensitive Plant has been more subject to observation than any other, on account of the singularity of its movements. If it be touched or shaken, if excessive heat or cold be applied, its leaves fold up, and the petiole is lowered, and hangs down upon the stem.

The *Dionæa Muscipula* offers another species of irritability still more singular: its leaves are composed of two lobes, united in the middle by a fleshy centre; if an insect touches these lobes, they approach each other, seize the poor sufferer, and pierce him to death, or starve him.

The extremity of the leaves of the *Nepenthes Distillatoria* is furnished with a vase and its lid: this vase becomes filled with a secreted liquid, and the lid opens and shuts according to the state of the weather.

Nutrition.

Vegetables, on analysis, are found to consist of *Oxygen*, *Hydrogen*, *Carbon*, and *Azote*, besides a multiplicity of compound salts and metallic oxides, all of which are supplied by the earth and air.

Water holds in solution a certain quantity of salts, and vegetable and animal matter: the roots absorb these substances with the water, and they are conveyed by the sap to the organic tissue, where a portion is assimilated by the plant, and the other portion passes off by transpiration.

The air supplies a quantity of hydrogen and azote, and a great abundance of carbonic acid gas.

The oxygen of the atmosphere also unites with the carbon of the plant, and forms carbonic acid gas, which is decomposed by light, and the carbon becomes fixed in the plant.

Plants absorb fluids by a power called suction, which is considered to be prodigious, being more considerable than the pressure of the atmosphere.

The fluids absorbed by the roots or leaves are conveyed to the entire vegetable by the large vessels of the wood, and especially by the soft layers of the alburnum. The explanation most generally received is the following :

The fluids pass upwards through the alburnum, and woody layers. They descend through the liber or cortex, and are dispersed horizontally by the medullary rays. When vegetation commences, the sap is accumulated in the youngest parts of the wood or branches, where it undergoes a certain process, and forms what is called cambium.

The circulation of the sap is assisted by caloric, which is a stimulant; by light, electri-

city, the rarefaction and condensation of air in the vessels, and by capillary attraction.

It was for some time imagined that the sap had two kinds of motion; an ascending one, in spring; and a descending one, in autumn; but this opinion is now abandoned. Some botanists imagined that the sap flowed upwards during the day, and downwards into the roots in the evening: this theory likewise is but weakly supported. There seems to be a constant tendency in the sap to rise, and diffuse itself in all the vacant spaces.

There are three modes of excretion in plants, viz. exudation, respiration, and transpiration.

The exudations consist of juices of various consistence, such as resins, oils, manna, sugar, wax, &c.; the viscid matter which escapes from the extremities of the hairs on rose trees; and the liquids which ooze from glands, pores, and nectaries.

Respiration, which includes also absorption, is attended with the separation of oxygen and carbonic acid gas: oxygen is disengaged during the day, but carbonic acid in the dark or at night.

The transpiratory fluid, which may be con-

sidered as excrementitious, is composed of water reduced to vapour, mixed with other principles, capable of solution and evaporation; such is the fluid that is found on *Cabbage* leaves in the morning.

The fluid which escapes from some plants is so great, that a *Sunflower*, of equal size, and in an equal space of time, perspires seventeen times more than a man.

ARTIFICIAL OR SEXUAL ARRANGEMENT OF PLANTS,

BY LINNÆUS.

ACCORDING to this system, plants are distinguished by the number, situation, relative size, and connexion of the stamens.

They are arranged in twenty-four Classes, which are designated by terms of Greek derivation.

The Orders are known by the number of pistils, the form of the fruit, or florets, and by natural divisions.

The Eleyen first Classes may be distinguished

by the number of stamens alone, the flowers being all perfect.

Class 1. MONANDRIA, has one stamen only. There are but few plants in this class.

Class 2. DIANDRIA, has two stamens.

Class 3. TRIANDRIA. This class has three stamens: the species of it are exceedingly numerous, including the natural order, *Gramina*.

Lolium Temulentum, and *Secale Cornutum*, are the only plants of this class which are poisonous.

Class 4. TETRANDRIA. The four stamens of this class are of equal length, which circumstance separates it from Class Didynamia, which has four unequal stamens, two being long, and two short.

Class 5. PENTANDRIA. This class has five stamens. Plants in the first order, which have a berry for their fruit, are for the most part poisonous. Plants of the second order, *Digynia*, if growing on a dry soil, are aromatic, whereas those growing in wet places, or in the water, are more or less poisonous.

Class 6. HEXANDRIA. In this class there are six stamens; all of equal length and the petals are not limited to four, as in *Tetradynamia*.

Many plants of this class are supplied with bulbs, commonly called bulbous roots.

Class 7. HEPTANDRIA has seven stamens.

Class 8. OCTANDRIA has eight stamens.

Class 9. ENNEANDRIA has nine stamens.

Class 10. DECANDRIA has ten stamens.

Class 11. DODECANDRIA, has from twelve to nineteen stamens.

Class 12. ICOSANDRIA, has twenty stamens or more, which are inserted into the calyx or corolla.

This class affords our principal fruits, as apples, pears, plums, &c. Plants producing fruit, and the stamens of which grow out of the calyx, are never poisonous.

Class 13. POLYANDRIA. This class is known by having numerous stamens, which grow out of the receptacle.

Most of the medicinal plants of this class are poisonous. As the number of stamens do not form a sufficient distinction between the classes Icosandria and Polyandria, the following rule may be attended to. If, when the calyx and petals are removed, the stamens remain attached to the receptacle, the plant may be determined as belonging to Class 13, Polyandria; but if the

stamens are removed by detaching the petals or calyx, the plant may then be referred to Class 12, Icosandria.

Class 14. DIDYNAMIA. This class has four stamens, of which two are long, and two short. It comprises the Ringent and Personate flowers.

Class 15. TETRADYNAMIA. This class is known by having six stamens, two of which are short, and four long. The flowers of plants of this class are for the most part cruciform; they are antiscorbutic, and contain more nitrogen than any other class.

Classes 16, 17, 18, 19, and 20 are known by the particular mode of union of the stamens, and not by their number.

Class 16. MONADELPHIA. The stamens are all united at their bases into one tube. It includes the natural order *Columniferae*.

Class 17. DIADELPHIA. The stamens are arranged in two bundles, which are sometimes united at their bases. The *Papilionaceae* are the most numerous in this class.

Class 18. POLYADELPHIA. The stamens are arranged in more than two bundles, as in the *Hypericum*.

Class 19. SYNGENESIA, contains Compound

flowers, which class consists of a congeries of small flowers, or tubular, or ligulate florets, inserted upon a common receptacle, and surrounded by a common calyx. The stamens in each floret are five in number, and are united so as to form a tube round the pistil.

Class 20. GYNANDRIA. In this class the stamens are united with the style or germen.

Classes 21, 22, and 23 are known by the stamens and pistils being found on separate flowers, or on separate plants.

Class 21. MONÆCIA, has the stamens in one flower, and the pistils in another, on the same plant.

Class 22. DIÆCIA, has the stamens and pistils on separate flowers, and on separate plants.

Class 23. POLYGAMIA, has three kinds of flowers, some with stamens only, others with pistils, and others with both; sometimes on the same plant, and sometimes on different ones.

Class 24. CRYPTOGAMIA, has the stamens and pistils indistinct, and the parts of fructification generally are difficult to distinguish and decide upon.

The Orders.

The Orders are generally known by the numbers of the pistils; but these are inadequate to form sufficient distinction in every case. The situation of the seeds, and the form of the seed-vessel, constitute characters of more importance. The orders of the thirteen first classes are known from the number of the pistils alone, and are the following:

<i>Monogynia</i>	has	one pistil.
<i>Digynia</i>	having	two pistils.
<i>Trigynia</i>	.	three pistils.
<i>Tetragynia</i>	.	four pistils.
<i>Pentagynia</i>	.	five pistils.
<i>Hexagynia</i>	.	six pistils.
<i>Heptagynia</i>	.	seven pistils.
<i>Octagynia</i>	.	eight pistils.
<i>Enneagynia</i>	.	nine pistils.
<i>Decagynia</i>	.	ten pistils.
<i>Dodecagynia</i>	.	twelve pistils.
<i>Polygynia</i>	.	numerous pistils.

The Orders of the Fourteenth Class are distinguished by their fruit. Thus:

Order 1. *Gymnospermia*, has its naked seeds, which are usually situated at the bottom of the calyx.

Plants of this order are for the most part wholesome.

Order 2. *Angiospermia*, has the seeds in a seed vessel. The plants of this order are generally poisonous.

The Orders of the Fifteenth Class are distinguished by the shape of the seed vessel:

Order 1. *Siliculosa*, has fruit of the shape of a rounded pod, as in the *Radish*.

Order 2. *Siliquosa*, bears a seed vessel of the form of a long pod, or *Siliquea*.

The Orders of Classes 16, 17, and 18 are distinguished in the same manner as those of the first thirteen.

The Orders of the Nineteenth Class are known by the arrangement of the florets:

Order 1. *Polygamia æqualis*, has the florets all perfect and similar, containing both stamens and pistils.

Order 2. *Polygamia superflua*, has the florets of the disk perfect. Those of the circumference contain a pistil only.

Order 3. *Polygamia frustanea*, has the florets of the disk perfect, and those of the circumference barren.

Order 4. *Polygamia necessaria*, has the florets of the disk with stamens only, and those of the circumference with pistils only.

Order 5. *Polygamia segregata*, bears several flowers with a separate calyx, all united in one common calyx; as in the *Globe Thistle*.

The Orders of Class 20, are known by the number of the stamens; those of the Twenty-first and Twenty-second Classes, by the stamens, or the arrangements of the filaments.

Class 23, has its Orders distinguished by the arrangement of the flowers on different plants :

Order 1. *Monœcia*, has the two or three different descriptions of flowers on the same plant.

Order 2. *Diœcia*, has the different descriptions of flowers on two separate plants.

Order 3. *Triœcia*, has different flowers on three different plants.

The Orders of Class 24, are natural divisions or families :

- | | |
|----------------------|-------------|
| 1. <i>Filices</i> , | Ferns. |
| 2. <i>Algæ</i> , | Flags. |
| 3. <i>Musci</i> , | Mosses. |
| 4. <i>Hepaticæ</i> , | Liverworts. |
| 5. <i>Fungi</i> , | Funguses. |

*A List of the Genera of the Plants enumerated
in the London, Edinburgh, and Dublin
Pharmacopœias.*

Class 1.

MONANDRIA.

Order 1. MONOGYNIA.

Zingiberaceæ *Alpinia*,
(*Cardamomum*.)
Zingiberaceæ *Curcuma*.
Zingiberaceæ *Zingiber*.

Class 2.

DIANDRIA.

Order 1. MONOGYNIA.

Phytolariaceæ *Gratiola*.
Rubiaceæ *Galipea* (*Cuspa-*
ria.)
Uleaceæ *Olea*.
Labiata *Rosmarinus*.
Labiata *Salvia*.
Veronica.

Order 3. TRIGYNIA.

Piperaceæ *Piper*.

Class 3.

TRIANDRIA.

Order 1. MONOGYNIA.

Crocus. *Iridaceæ*
Iris. *Iridaceæ*.
Valeriana. *Valerianaceæ*.

Order 2. DIGYNIA.

Avena. *Graminaceæ*
Hordeum. *Do*
Saccharum. *Do*
Secale. *Do*
Triticum. *Do*

Class 4.

TETRANDRIA.

Order 1. MONOGYNIA.

Dorstenia. *Urticaceæ*
Krameria. *Polypodiaceæ*
Rubia. *Rubiaceæ*

Class 5.

PENTANDRIA.

Order 1. MONOGYNIA.

Anchusa.

Solanaceæ Atropa.

Do. Capsicum.

*inchonaceæ Calicocca (olim
Cephaelis.)*

2^{do}, Cinchona.

musculaceæ Convolvulus.

Solanaceæ Datura.

*Rutaceæ Diosma (Buchu.)
Erythræa (olim Chi-
ronea.)*

Solanaceæ Hyoscyamus.

gentianeæ Menyanthes.

Solanaceæ Nicotiana.

Rhamnaceæ Rhamnus.

Solanaceæ Solanum.

Spigelia.

Loganiaceæ Strychnos.

Violaceæ Viola.

Vitaceæ Vitis.

Angelica.

Bubon.

Carum.

Conium.

Coriandrum.

Cuminum.

Daucus.

Eryngium.

Ferula.

Gentiana.

Heracleum.

Pastinaca.

Pimpinella.

Ulmus.

Order 3. TRIGYNIA.

Rhus.

Sambucus.

Order 5. PENTAGYNIA.

Linum.

Class 6.

HEXANDRIA.

Order 2. DIGYNIA.

Anethum.

Order 1. MONOGYNIA.

Acorus.

<i>Allium.</i>	Order 3. TRIGYNIA.
<i>Aloe.</i>	<i>Rheum.</i>
<i>Scilla.</i>	
Order 3. TRIGYNIA.	Class 10.
<i>Colchicum.</i>	DECANDRIA.
<i>Rumex.</i>	Order 1. MONOGYNIA.
Class 7.	<i>Arbutus.</i>
HEPTANDRIA.	<i>Boswellia.</i>
Order 1. MONOGYNIA.	<i>Cassia, (Senna.)</i>
<i>Æsculus.</i>	<i>Cathartocarpus,</i> <i>(olim Cassia</i> <i>Fistula.)</i>
Class 8.	<i>Copaifera.</i>
OCTANDRIA.	<i>Guaiacum.</i>
Order 1. MONOGYNIA.	<i>Hæmatoxylon.</i>
<i>Amyris.</i>	<i>Myroxylon.</i>
<i>Daphne.</i>	<i>Quassia.</i>
Order 3. TRIGYNIA.	<i>Rhododendron.</i>
<i>Polygonum.</i>	<i>Ruta.</i>
Class 9.	<i>Styrax.</i>
ENNEANDRIA.	<i>Swietenia.</i>
Order 1. MONOGYNIA.	<i>Toluifera.</i>
<i>Laurus.</i>	Order 2. DIGYNIA.
	<i>Dianthus.</i>

Order 5. PENTAGYNIA. Order 5. PENTAGYNIA.

Oxalis.

Pyrus.

Class 11.

DODECANDRIA.

Order 1. MONOGYNIA.

Asarum.

Canella.

Lythrum.

Order 8. POLYGYNIA

Geum.

Rosa.

Tormentilla.

Class 13.

POLYANDRIA.

Order 2. DIGYNIA.

Agrimonia.

Order 1. MONOGYNIA.

Dryobalanops.

Order 3. TRIGYNIA.

Euphorbia.

Papaver.

Order 3. TRIGYNIA.

Aconitum.

Class 12.

ICOSANDRIA.

Delphinium.

Order 1. MONOGYNIA.

Amygdalus.

Caryophyllus (olim

Eugenia.)

Myrtus.

Prunus.

Punica.

Order 4. TETRAGYNIA.

Winteria.

Order 6. POLYGYNIA.

Helleborus.

Class 14.

DIDYNAMIA.

Order 1. GYMNOS-
PERMIA.*Hyssopus.**Lavendula.**Marrubium.**Melissa.**Mentha.**Origanum.**Teucrium.*

Order 2. ANGIOSPERMIA.

*Digitalis.**Scrophularia.*

Class 15.

TETRADYNAMIA.

Order 1. SILICULOSA.

Cochlearia.

Order 2. SILIQUOSA.

*Cardamine.**Sinapis.*

Class 16.

MONADELPHIA.

Order 1. TRIANDRIA.

Tamarindus.

Order 8. POLYANDRIA.

*Malva.**Althæa.*

Class 17.

DIADELPHIA.

Order 3. OCTANDRIA.

Polygala.

Order 4. DECANDRIA.

*Astragalus.**Stizolobium (olim
Dolichos.)**Geoffræa.**Liquiritia (olim
Glycyrrhiza.)**Pterocarpus.**Spartium.*

Class 18.	Class 20.
POLYADELPHIA.	GYNANDRIA.
Order 3. ICOSANDRIA.	Order 4. HEXANDRIA.
<i>Citrus.</i>	<i>Aristolochia.</i>
<i>Melaleuca.</i>	
Class 19.	Class 21.
SYNGENESIA.	MONŒCIA.
Order 1. POLYGAMIA	Order 1. MONANDRIA.
ÆQUALIS.	<i>Euphorbia.</i>
<i>Arctium.</i>	
<i>Lactuca.</i>	
<i>Leontodon.</i>	Order 4. TETRANDRIA.
Order 2. POLYGAMIA	<i>Morus.</i>
SUPERFLUA.	
<i>Anthemis.</i>	Order 7. POLYANDRIA.
<i>Arnica.</i>	<i>Arum.</i>
<i>Artemisia.</i>	<i>Quercus.</i>
<i>Inula.</i>	
<i>Solidago.</i>	Order 8. MONADELPHIA.
<i>Tanacetum.</i>	<i>Croton.</i>
<i>Tussilago.</i>	<i>Cucumis.</i>
Ord. 3. POLYGAMIA	<i>Momordica.</i>
FRUSTRANEA.	<i>Pinus.</i>
<i>Centaurea.</i>	<i>Ricinus.</i>

Class 22.

DİÆCIA.

Order 2. DIANDRIA.

Salix.

Order 5. PENTANDRIA.

*Humulus.**Pistacia.*

Order 6. HEXANDRIA.

Smilax.

Order 10. DODECAN-

DRIA.

Menispermum (Ca-
lumba.)

Order 13. MONADEL-

PHIA.

*Juniperus.**Myristica.*

Class 23.

POLYGAMIA.

Order 1. MONÆCIA.

*Acacia.**Stalagmitis.**Veratrum.*

Order 2. DİÆCIA.

*Ficus.**Fraxinus.*

Class 24.

CRYPTOGAMIA.

Order 1. FILICES.

Aspidium.

Order 3. ALGÆ.

Fucus.

Order 5. LICHENES.

Cetraria Islandica
(olim Lichen.)

Order 6. FUNGI.

Boletus.

GLOSSARY
OF
BOTANICAL TERMS.

Abbreviatus, shortened.

Abortivus, abortive; applied to flowers which produce no perfect seed.

Abruptus, abrupt; when the extremity of a part is apparently cut off transversely, or applied to a compound leaf, that has not an odd leaflet.

Abrupte pinnatus, abruptly pinnate; not terminating in a leaflet or a tendril.

Acalycis, destitute of a calyx.

Acaules; applied to plants destitute of stems or stalks.

Acerosus, acerose, needle-shaped; that is, of equal breadth, acute, and rigid.

Acicularis, needle-shaped, or sharp-pointed.

Achlamydeous, having no floral envelope.

Acinaciforme, scimitar-shaped; applied to leaves having one edge thick and straight, the other thin and curved.

Acinus, a separate part of a compound berry, containing seeds ; as in the strawberry, mulberry, &c.

Acotyledonous ; applied to embryos destitute of lobes or seminal leaves, as in ferns, mosses, &c.

Aculeate, prickly.

Aculeus, a prickle ; as on the rose.

Acuminate, *acuminatus*, sharp-pointed, ending in an awl-shaped point.

Acutus, acute, sharp-pointed.

Adnatus, adnate ; applied to a leaf adhering to the stem or stalk by the surface of the leaf itself, or to stipules fixed to petioles.

Ascendens, ascending obliquely without support.

Æqualis, equal, applied to one of the orders of class Syngenesia.

Æstivation is the term applied to the arrangement and form of a flower before it is unfolded.

Aggregate flowers, composed of many florets, situated upon one common receptacle. The florets are separate, and generally have each its proper calyx and peduncle.

Aggregate peduncles, are clustered flower-stalks growing together.

Alæ, wings, which are portions of a papilionaceous flower.

Albugo, mildew; considered to be a collection of parasitical plants, belonging to the class Cryptogamia.

Alburnum, soft new layers of the wood.

Alatus, winged.

Alienatus, alienated; applied to the first leaves, which give place to others very different from them.

Alternus, alternate; applied to leaves placed alternately and single on the sides of the stem, or to branches or flowers arranged in the same manner.

Alterne, alternately.

Alveolatus, honey-combed.

Amentum, ament, catkin; is a species of inflorescence and calyx combined, consisting of a common receptacle of a cylindrical form, beset with chaffy scales, and placed on a slender thread-like stalk.

Amplexicaulis, amplexicaul, stem-clasping; applied to the base of a leaf which partly surrounds the stem.

Anamorphosis, applied to parts, which are formed by an excess of cellular substance.

Anceps, two-edged, having two angles or edges.

Androgynus, applied to plants bearing stamens and pistils in separate flowers.

Angiospermia, having the seeds in a vessel.

Angulatus, angular.

Angustifolius, narrow-leaved.

Annuus, annual ; perishing during the year.

Anomalus, anomalous ; applied to corollas consisting of different sized petals, and not being papilionaceous.

Anthera, anther ; the part of the stamen which, by throwing out the pollen, or dust, fertilizes the stigma.

Anthocorinum, a coloured appendage found upon the flower-stalk of *Surulea*.

Anticus ; applied to a part placed before another.

Apetalus, not having petals.

Apex, the point of a leaf or other part.

Aphyllus, leafless.

Appendiculatus, appendaged ; applied to petioles with leafy films at the base, and to seeds furnished with hooks, scales, &c.

Appendages are parts of plants not common to all, but peculiar to certain ones ; such as, floral leaves, stipules, thorns, prickles, tendrils, glands, and hairs.

Appressus, appressed ; applied to leaves pressed close to the stem, also to peduncles.

Arachnoides, cobwebbed.

Arborescent, becoming woody.

Arboreus, arboreous, perennial ; with a single stem.

Arcuatus, bowed.

Arillus, aril ; a complete or partial covering of a seed, fixed to its base, and enveloping the other parts.

Arista. Vide Awn.

Arrow-shaped, *sagittatus* ; applied to triangular-shaped leaves.

Articulatus, articulated ; applied to a leaf or leaflet growing out of the summit of another, to stems divided by joints or knots, or by contractions, and to culms with joints.

Ascendens, ascending in an oblique direction.

Asper, rough.

Asperifolia, rough-leaved.

Assurgens, rising.

Attenuatus, attenuated ; diminished in size from the base to the summit.

Auriculatus, auricled ; applied to leaves furnished with a pair of leaflets, ear-shaped.

Avenis, veinless ; applied to leaves.

Awl-shaped, *subulatus*; applied to leaves thick at the base, and gradually tapering to a point.

Awn, *arista*; a bristle-like projection growing out of the glume, as in barley.

Awnless, *muticus*.

Axillaris, axillary; applied to peduncles proceeding from the junction and angle formed by the leaf and stem, called the *axilla*, or to flowers, or spikes of flowers similarly situated.

Bacca, a berry, a form of fruit, in which the seeds are surrounded by a pulp.

Bacciferus, bearing berries.

Banner or standard, *vexillum*; the upper and largest petal of a papilionaceous flower.

Barbatus, bearded.

Bark, *cortex*, a covering of the stem under the epidermis, and between it and the wood an additional layer is added yearly.

Barren Flowers are flowers with stamens only, and which produce no fruit.

Battledoor-shaped, *spatulatus*.

Beaded, *granulatus*; in the form of little knots, as the root of Saxifrage.

Beak, an elongation of the seed vessel; a part proceeding also from the permanent style.

Bell-shaped, *Campanulatus*.

Bellied, *ventricosus* ; distended in the middle.

Bent, *cernuus* ; applied to fruit-stalks.

Biennial, growing for two years, and then dying away.

Bicapsularis, having two capsules.

Bicornes, two-horned.

Bifarius, pointing from opposite sides.

Biflori pedunculi, peduncles bearing two flowers.

Bifidus, bifid ; two-cleft.

Bigeminatus, bigeminate ; applied to a compound leaf with a forked petiole, or to one with several petioles, or leaflets, at the end of each division.

Bijugus, in two pairs.

Bill, *rostrum* ; an appendage to a seed.

Bilobus, two-lobed.

Bilocular, two-celled.

Bina, two upon a plant.

Binatus, binate ; applied to a leaf consisting of two leaflets, inserted at the same point, on the summit of the petiole.

Bipinnatus, bipinnate ; doubly feathered.

Bird-footed, *pedatus*.

Biternate ; applied to a petiole which divides into two smaller ones, each of which bears three leaflets.

Bitten, as if gnawed off by an animal.

Bladders, *vesiculæ*, air-bags found on some species of fucus.

Blistered, *bullatus* ; applied to parts of the surface of the leaf, which are raised above the veins irregularly.

Brachiatus, brachiate ; applied to four-ranked stems, bending in four directions.

Bractea, floral leaf or appendage different in colour from the leaves.

Bracteatus, bracteated, having a bractea, applied to peduncles, a flower, or a cyme.

Bristles, strong stiff hairs.

Buds, *gemmae*, the hybernacle of a flower, or leaves.

Bulbous roots, *radix bulbosa* ; a compact root, which encloses in its centre the embryo of a plant.

Bullatus, blistery ; applied to the round prominent parts of a cabbage leaf, occasioned by very tight veins.

Bunch, *thyrsus* ; applied to flowers growing in clusters, like the lilac.

Bundle, *fasciculus*, a kind of inflorescence.

Caducus, caducous ; applied to leaves falling off

before the end of summer, to corollas falling off before the perfection of the stamens, and to calyxes falling off before the corolla is unfolded.

Calyculate, implies that little scales are placed at the outside of the base of the calyx.

Calyptra, the calyx of mosses.

Calyx, calyx; the flower-cup, generally of the colour of the leaves.

Campanulate, applied to corollas of the form of a bell.

Cancellatus, latticed.

Capillaris, hair-like.

Capitulum, a head of flowers.

Capreolus, a tendril.

Capsula, capsule; a seed-vessel formed into cells like the poppy.

Carina, a keel.

Carnosus, fleshy.

Carpellum, a carpel, or pistil, which, when ripe, forms the fruit.

Cartilagineus, cartilaginous; applied to the hard horn-like substance of some leaves.

Catkin, amentum.

Cauda, a tail.

Caudex, the stem; which includes the trunk and portion of the root.

Caulinus, cauline; applied to leaves growing on the stem, to flowers similarly placed, and to peduncles arising out of the main stem.

Caulis, the stem.

Cavus, hollow.

Cells, *loculi*; are hollow places in seed-vessels, for the reception of the seeds.

Cellulares, applied to plants without spiral vessels.

Cernuus, bent; applied to the fruit-stalk.

Channelled; applied to leaves, stalks, or petioles, having grooves or longitudinal furrows on their surface.

Chive, a stamen.

Cicatriscatus, scarred.

Ciliatus, ciliate or fringed; applied to parts bordered with soft parallel hairs.

Cirrhus, cirrhose; having a tendril growing from the extremity.

Cirrhus, a tendril.

Clammy, *viscosus*.

Clausus, closed.

Clavicula, a tendril.

Claw, *unguis*; the lower portion of a petal, which stands in the calyx of cruciform plants.

Climbing, *scandens*; applied to plants which support themselves by other bodies, by means of their tendrils.

Clinanthium, a swelled receptacle of compound flowers.

Close, *conglomeratus*.

Cloven, *fissus*; straight linear divisions.

Clubbed, *clavatus*; applied to parts growing thicker towards their extremity.

Cluster, *racemus*.

Clustered, *confertus*; parts crowded together.

Coadunatus, joined together at the base.

Coarctatus, compact.

Cochleatus, convoluted like a snail-shell.

Coloratus, coloured; applied to coloured leaves, not green.

Columella, column; the central point of union of the partitions of seed-vessels.

Coma, a tuft of leaves; as on the pine-apple and *fritillaria imperialis*.

Complete Flower, *flos completus*, furnished with calyx and corolla, stamens and pistils.

Compositus, compound; applied to leaves con-

sisting of a number of leaflets, all united by means of stalks to one common stalk.

Compound Flowers, are those of the nineteenth class; they consist of a number of florets, having a calyx, stamens, and pistil, inserted into one common base or receptacle.

Compressus, compressed; applied to leaves flattened laterally.

Conduplicatus, conduplicate or folded; applied to leaves, the margins of which are brought together in a parallel direction.

Cone, *strobilus*; a catkin hardened and enlarged into a seed-vessel.

Confluent, running one into the other, or crowded.

Conjugatus, conjugate or yoked; applied to leaves consisting of one pair of *pinnæ*, or leaflets.

Connatus, connate; applied to leaves united at their base, so as to appear one leaf.

Corculum, the heart of a seed.

Cordatus, heart-shaped.

Coriaceus, leathery.

Corniculatus, horn-shaped.

Corolla, corolla; the blossom.

Corymbus, corymb; a collection of flowers whose stalks, being of different lengths, form nearly an even surface at the top.

Costatus, ribbed.

Cotyledones, cotyledons; the large lobes of seeds, which nourish the young embryo; when the stem rises, they are raised from the ground, and perform the functions of leaves.

Crenatus, crenate or notched.

Creeping, *repens*; applied to stems running along the ground, and giving out roots; and applied to roots in like manner.

Crescent-shaped, *lunatus*; applied to leaves shaped like a half-moon.

Crispus, curled.

Cross-pairs, *decussatus*; applied to parts growing in pairs, the adjacent ones always growing in a different direction to each other.

Crowded, *confertus*; like the branches of the Yew.

Cruciformis, cruciform; cross-shaped flowers.

Cubitus, a measure of about eighteen inches in length.

Cucullatus, hooded, cone-shaped.

Culmus, a culm, is a stem peculiar to grasses and some other plants.

Curled, *crispus*; applied to the twisted curled appearance of the border of leaves.

Cuspidatus, cuspidate; applied to leaves terminating in rigid spines.

Cuticula, cuticle; the outer coat or skin of plants, generally transparent, and of various degrees of thickness.

Cylindrical, applied to parts of flowers which have a cylindrical form.

Cyma, cyme; a kind of inflorescence; it resembles an umbel, but has its peduncles differently divided.

Decagynia, having ten pistils.

Decandria, having ten stamens.

Deciduus, deciduous; applied to parts which fall off at the approach of winter, or after performing their functions long enough for the uses of the plant.

Decompositus, decompound or doubly compound; applied to leaves, whose petioles, instead of bearing leaflets, branch out into other petioles, to which the leaflets are attached.

Declinatus, declined; applied to parts bending down archwise.

Decurrens, decurrent; applied to the base of

leaves running down the stem, forming a border or wing, and to other parts extending downwards on the stem.

Decussatus, decussated; applied to parts crossing each other, or alternately opposite.

Deltoides, deltoid; trowel-shaped, or in the shape of a Greek delta.

Defending, *muniens*; applied to converging leaves, which cover and defend delicate parts during the night.

Demersus, immersed under water.

Dendroides, shrub-like.

Dentatus, dentate or toothed; having horizontal or projecting teeth.

Depressus, depressed; applied to leaves flattened vertically, or pressed close to the ground.

Determinatè Ramosus, abruptly branched.

Diamond-shaped, or rhomboid, *rhombeus*; applied to leaves of a square shape, with unequal angles.

Dichotomus, dichotomous, or forked; applied to stems dividing into two parts.

Dicoccus, applied to two capsules united, each with elastic cells.

Dicotyledonous, dicotyledonous; applied to plants having two cotyledons, or seminal leaves.

Diffusus, spreading.

Digitatus, digitate, or fingered; applied to leaves formed like fingers of three, four, five, or seven leaflets.

Digitus, a digit; the length of about three inches.

Diœcia, diœcious; applied to plants with male and female flowers, on different plants.

Discus, disk; the centre of a compound flower.

Dipetalus, dipetalous; applied to corollas having two petals.

Dispermus, two-seeded.

Dissepimentum, a partition.

Distichus, distichous, two-ranked; applied to leaves occupying two sides of a branch; to branches spreading in horizontal directions, and to flowers placed in opposite ranks.

Divergens, diverging; applied to leaves approaching at the base, and open at the summit.

Dolabriform, hatchet-shaped.

Dorsalis, fixed to the back.

Dotted, *punctatus*; having dots or vesicles.

Down, *lanugo*; the soft short hairs covering various parts of a plant.

Drooping, *cernuus*; pointing to the ground.

Drupa, drupe; a pulpy pericard, containing a nut.

Dust, pollen of the anther; each particle of dust is a bag, which bursts and emits a subtile vapour.

Ellipticus, elliptical or oval; applied to leaves of equal breadth, rounded at each end.

Emarginatus, emarginate or notched; applied to leaves terminating in a notch at the summit.

Emerged, *emersus*; applied to those leaves which are raised above the water, the others being under.

Embryo, embryo or germ; the essential part of the seed, being the rudiment of the plant.

Empalement, the calyx.

Endorrhiza, applied to plants in which the radicle ruptures the base of the embryo.

Enodis, jointless.

Endogenous; plants are so called when their stem is formed by additions to its centre.

Ensiform, sword-shaped.

Entire leaf, *folium integerrimum*; applied to leaves free from indentations or notches.

Ephemerus, applied to flowers which last only one day.

Epidermis, cuticle.

Equal corolla; divisions of the corolla equal.

Equitans, equitant; applied to leaves disposed in opposite rows, covering each other at their base.

Erectus, erect or upright; applied to leaves forming an acute angle with the stem; to branches rising in an upright direction; to petioles rising perpendicularly; and to flowers and peduncles likewise.

Erosus, erose or jagged; irregularly cut or notched; having the appearance of being gnawed.

Etiolation; blanching produced by privation of light and an accumulation of oxygen.

Evergreen, *sempervirens*; applied to leaves continuing green throughout the winter, so that the branches are never bare.

Eye or scar, *hilum*; the spot of the seed where it was fixed to the receptacle: nourishment was conveyed through it.

Exoticus, exotic, foreign.

Exogenous, applied to stems which increase by additional lays to the outside of the wood.

Exsertus, protruding.

Falling, deciduous.

Fasciculatus, fascicular; clustered.

Fasciculas, a fascicle; a collection of flowers on little stalks, connected together at the top, in a level bundle.

Faux, the mouth, or throat of a blossom.

Feathery, *plumosus*; hairy.

Ferns, *filices*.

Fertile flowers, have stamens and a pistil, and produce seed.

Fiddle-shaped, *panduriforme*; oblong and contracted at the sides.

Filamentum, a filament; a part of the anther.

Filiforsis, filiform or thread-like; parts of thread-like appearance and size.

Fissus, cloven.

Fistulous, hollow.

Fleshy, *carnosus*; applied to leaves of thick pulpy substance.

Flagelliformis, flagelliform; long and pliant.

Flagellum, a runner.

Flexuosus, flexuose or zigzag; applied to parts of a zigzag form.

Flint, *silica*; a vegetable secretion in certain plants.

Floret, *flosculus*; a small monopetalous flower.

Floriferus, floriferous; flower bearing.

Folium, a leaf.

Folliculus, follicle or bag; a membranous seed-vessel of one valve and one cell.

Fornicated, vaulted.

Fringed, ciliate.

Frons, frond; a peculiar union of the fructification with the leaf and stem.

Frutex, a shrub.

Funnel-shaped, *infundibuliformis*.

Fusiformis, spindle-shaped.

Galea, a helmet.

Geminis, in pairs.

Gemmaceus, gemmaceous; applied to flower-stalks growing out of leaf-buds.

Geniculatus, geniculate; applied to parts bent like the knee.

Genus, signifies a family of plants containing various species.

Germem, germen; the enlarged base of the pistil, which forms the rudiment of the fruit and seed.

Gibbus, gibbous; applied to parts having both sides convex.

Glaber, smooth.

Glandula, a gland, is a little tumor or vesicle found on various parts of plants.

Glandulosus, glandular; applied to parts beset with glands.

Glaucus, glaucous; applied to leaves of a sea-green colour.

Globosus, globular.

Glomeratus, congregated.

Gluma, glume; the outer husk of corn or grasses.

Gramina, grasses.

Granulatus vel articulatus, granulated; applied to jointed roots, of a scaly nature, very much allied to Bulbs.

Gymnospermia, bearing naked seeds.

Hairs, *pili*; little bristly bodies, growing out of the plant, for its protection from insects or cold.

Halbert-shaped, *hastatus*; applied to leaves hollowed out at the base and sides, but with spreading lobes.

Hatchet-shaped, *dolabriformis*; applied to leaves cylindrical at the base, the upper part dilated, the upper edge being thickest.

Heart-shaped, *cordatus*; applied to leaves.

Herbaceous, applied to stems which perish annually down to the root.

Hians, gaping open.

Hispidus, hispid, bristly.

Hoary, *incanus*; covered with silky hairs, or scaly mealiness: applied to parts of whitish colour.

Hoof-shaped, *ungulatus*.

Horizontalis, horizontal; applied to parts spreading and forming a right angle with the stem.

Hybrida, or mules, are plants resulting from the contact of pollen of one flower with the pistil of another.

Hypocrateriformis, salver-shaped.

Imbricatus, imbricated; applied to parts placed one over the other, like tiles.

Indigenus, indigenous; growing wild in the country.

Incomplete, *flos incompletus*; flowers wanting the corolla; or the corolla wanting some of the usual parts.

Incurvus, or inflexus; curved inwards.

Inermis, unarmed.

Inferus, beneath.

Inflorescentia, inflorescence; the situation of the flowers upon the plant. There are ten kinds of inflorescence, viz. whorl, raceme, spike, corymb, fascicle, head or tuft, umbel, cyme, panicle, and bunch.

Infundibuliformis, funnel-shaped.

Integerrimus, entire.

Internodis, internodal; applied to a stalk or leaf proceeding from the space between two nodi.

Interruptedly, *interruptè*; applied to compound leaves, when the principal leaflets are intermingled with smaller ones; and to spikes of flowers with small spikes intermingling with the larger ones.

Involucellum, a partial involucre, surrounding the base of an umbellule.

Involucrum, involucre; a kind of calyx, composed of many leaves, surrounding the base of the stalks of umbellate flowers. The involucre surrounding partial umbels is called an involucrel.

Involutus, involute; applied to leaves with their margins rolled upon each other.

Involving, *involvens*; parts rolling upon each other, and protecting something underneath them.

Irregular corolla, has parts of the corolla unequal and dissimilar.

Jagged-pointed, *præmorsus*; applied to leaves very blunt, with deep notches.

Jointed. Vide Articulated.

Juga, in pairs.

Keel, *Carina*; part of a papilionaceous flower, composed of two petals, which protect the fructification.

Keeled, *Carinatus*; applied to leaves with their back prominent longitudinally.

Knotty, *nodosus*.

Labiatus, labiate or lipped; applied to parts whose segments have the form of lips.

Laciniatus, laciniated, jagged; applied to leaves divided into numerous irregular portions.

Lactescent, abounding with milky juice.

Lanceolatus, lanceolate; applied to leaves narrow, oblong, and tapering at the end.

Lanugo, soft wool or down.

Lateralis, lateral: applied to parts situated at the side of the stem, or laterally to its insertion.

Laxus, loosely spreading.

Leather-like, *coriaceous*; leaves of hard and thick consistence.

Legumen, legume; a seed-vessel peculiar to plants of the Pea kind.

Ligulatus, ligulate; strap or riband shaped.

Limbus, limb; the outer portion of a monopetalous flower; also the large flat portion of leaves.

Linearis, linear; applied to leaves of equal breadth from the base to the apex.

Lingulatus, tongue-shaped.

Lobatus, lobed; the segment of leaves being rounded.

Lomentum, a kind of leguminous seed-vessel, divided into cells by transverse partitions.

Lopped, *truncatus*; as if cut off with a pair of scissors.

Lyratus, lyrate; applied to leaves divided transversely into several segments, which increase towards the extremity.

Maculatus, spotted.

Masculi, male flowers.

Medulla, vide Pith.

Membranous, *membranaceus*; applied to parts of a thin pliable texture or substance.

Mid-rib, the principal nerve of a leaf, which runs along the middle.

Milk, *lac*; a vegetable secretion, which bears some resemblance to animal milk.

Monocotyledones, monocotyledonous plants; whose embryos have only one cotyledon.

Monœcia, monœcious; applied to plants which have the stamens and pistils on separate flowers, but on the same plant.

Monopetalus, monopetalous; flowers consisting of only one petal.

Monophyllus, monophyllous; calyxes consisting of only one leaf.

Monostachyos, single spiked.

Muricatus, covered with sharp points.

Naked, *nudus*; applied to flowers without calyxes, to stems without leaves, or to leaves without hair or down.

Navicularis, boat-shaped.

Nectarium, nectary; that portion of the flower which secretes the honey: it is either part of the corolla, or separate.

Nervosus: vide Ribbed.

Nicked: vide Emarginate.

Nidulantia, applied to seeds dispersed in pulp.

Nitidus, polished ; smooth and shining.

Nodi, knots, or hardened portions of the gramina, where the leaves shoot out, and buds are formed.

Nucleus, a kernel.

Nut, *nux*; a hard shell enclosing a kernel.

Obliquus, oblique or twisted; leaves with one part horizontal, the other vertical.

Oblongus, oblong; leaves several times longer than broad.

Obovatus, obovate; egg-shaped, with the larger end at the extremity.

Ovatus, ovate or egg-shaped; the broadest end is towards the base of the leaves.

Operculum, a lid.

Oppositus, opposite; applied to leaves placed exactly opposite; to branches growing in pairs; and to peduncles opposite.

Orbiculatus, orbicular or circular.

Palea, chaff.

Palmatus, palmate; applied to leaves divided down to their centre into several segments.

Panicula, panicle; a form of inflorescence in which the flowers are scattered on peduncles without order.

Papilionaceus, papilionaceous; applied to flowers of the form of a butterfly, as the pea-blossom.

Papillosus, papillose; applied to stems covered with soft tubercles, and to leaves covered with fleshy points or dots.

Pappus, pappus or seed-down, is the feathery, bristly, or chaffy appendage, which crowns many seeds.

Parasitical, growing on some other plant, and deriving its nourishment therefrom.

Partition, *dissepimentum*, is that part which divides a capsule into cells.

Patentia, spreading.

Pectinatus, pectinate; applied to leaves feather-cleft, the segments resembling the teeth of a comb.

Pedatus, pedate; bird-footed.

Pedicillus, pedicel; a partial flower-stalk.

— *Pedunculus*, peduncle; a stalk that bears the flowers and fruit. *Hyacinth*

Pellicula, a pellicle; a membranous or mucilaginous covering which adheres to some plants.

Peltatus, peltate; applied to leaves when the footstalk is inserted into the middle of the leaf.

Pentagonus, or quinquangularis; five-angled.

Pentagynia, the name of an order bearing five pistils.

Pentandria, the name of the fifth class: five stamens in each flower.

Perennial, lasting for many years, or at least more than two.

Perfect flower, *flos perfectus*; a flower having stamens and pistils.

Perfoliatus, perfoliate; applied to leaves with the stalks running through them.

Perianthium, perianth; the calyx is so called when contiguous to, or forming part of the flower.

Pericarpium, pericarp; a seed-vessel, is of ten different kinds, viz. drupe, pome, berry, follicle, silique, silicle, legume, capsule, nut, and strobile.

Perichætium, an involucre surrounding the footstalks of mosses.

Permanent, applied generally to the calyx; when it remains on the plant after the fruit is ripe.

Personatus, personate; applied to a monopetalous corolla, the borders of which resemble closed lips.

Petalum, petal; the leaf of the corolla.

Petiolus, petiole; the stalk which connects leaves or footstalks.

Petiolatus, petiolate; applied to leaves supported by a petiole.

Pileus, a cap or hat.

Pillar, a little shaft or stem supporting part of the down of some seeds: the term is applied also to the receptacle, around which the capsules are placed, as in the Mallow.

Pilosus, hairy.

Pilus, hair.

Pinnatifidus, pinnatifid; is applied to parts cut transversely into deep oblong parallel segments.

Pinnatus, pinnate; a species of leaf, composed of many leaflets, placed on each side of the petiole, alternate, opposite, or decurrent.

Pistillum, pistil; an organ situated in the centre of the flower, forming the rudiment of the fruit: a pistil is generally composed of the germen, style, and stigma.

Pith, *medulla*; a soft spongy substance which occupies the central canal of the stem of most dicotyledonous plants.

Plaited, *plicatus*; applied to parts lying in folds like a fan.

Plumelet, *plumula*; the ascending part of the corculum, containing the infant stem and leaves.

Pod, *siliqua*; a long seed-vessel.

Pointed, *acuminatus*; applied to leaves which terminate in an awl-shaped point.

Pollen, the fecundating substance secreted by the anther.

Polyadelphia, the name of the eighteenth class: the stamens are united by their filaments into three or more sets.

Polyandria, the name of the thirteenth class, in which there are more than twenty stamens fixed to the receptacle.

Polygamia, the name of the twenty-third class of Linnæus's Artificial System. In it there are three sorts of flowers on the same or on separate plants, some containing stamens, some pistils only, and others both.

Polygynia, the name of one of the orders; implying that there are several pistils.

Polypetalous, applied to a corolla or flower having more than one petal.

Polyphyllous, applied to many-leaved calyx.

Pouch, *silicula*; a seed-vessel of a roundish form.

Procumbent, *procumbens*; lying on the ground.

Prolifer, prolific; bearing branches from the extremities of former ones.

Prostrate, *prostratus*; applied to a stem trailing along the ground.

Pubescens, pubescent; applied to parts covered with down or hairs.

Punctatus, dotted.

Quaterna, *quina*, &c. when four, five, or more, grow together.

Quinatus, quinate; implies parts divided into fives.

Raceme, *racemus*; a bunch, as grapes.

Radical leaves, *folia radicalia*, are leaves which appear to spring from the root.

Radicans, clinging to any other body for support by means of fibres which do not imbibe nourishment.

Radius, ray, is the margin of compound flowers.

Ramosus, ramose; applied to flowers growing on branches; to peduncles proceeding from the branch; and to leaves growing on branches differing from those of the stem.

Ramosissimus, much branched.

Receptaculum, receptacle; the basis or point on which all the parts of fructification rest: the receptacle assumes different forms and uses.

Reclined, *reclinatus*; applied to leaves with

their extremities lower than the base, and to stems bent towards the ground.

Recurvus vel *reflexus*, recurved; leaves curved backwards.

Regular corolla, implies that the parts of the corolla are uniform.

Reniform, kidney-shaped.

Repandus, wavy.

Repens, creeping along the ground.

Resupinatus, resupinate or reversed: applied to leaves with their face turned downwards.

Retusus, retuse; applied to leaves ending in a broad shallow notch or sinus.

Revolutus, revolute; applied to leaves having their margins turned towards the under surface.

Rhombeus, diamond-shaped.

Ribbed, *costatus* vel *nervosus*; applied to leaves which have ribs or lines extending from the basis to the apex.

Ribless, *enervis*; applied to leaves without ribs or nerves.

Ringens, ringent; applied to a monopetalous corolla, the border of which is divided into two lips.

Rosaceus, rosaceous or rose-like; applied to polypetalous corollas, spreading like a rose.

A Root is that part of the plant which grows in the earth, and supplies the rest with nourishment.

Rostrum, a beak.

Rotatus, wheel-shaped.

Roundish, *subrotundus*; applied to leaves approaching to a circular form.

Rugosus, rugged or wrinkled; applied to leaves with inequalities rising above the veins.

Runcinatus, runcinate or lion-toothed; applied to leaves cut into several transverse acute segments, pointing towards the base of the leaf.

Runner, *flagellum*; a barren twig or shoot which lies upon the ground.

Sagittatus, arrow-shaped.

Sap, the juice of plants.

Salver-shaped, *hypocrateriformis*; applied to a monopetalous corolla, with the limb spread out horizontally.

Sarmentosus, sarmentose or trailing, is applied to suckers or stems thrown off to form fresh roots.

Scabrous, *scaber*, rough, with little inequalities.

Scaly, *squamosus*; applied to parts covered with scales.

Scandens, climbing.

Scapus, *a scape*, is a tender stalk springing from the root, and bearing the flower and fructification, as in colchicum.

Scattered, *sparsus*; applies to parts placed irregularly.

Seam, the line formed by the meeting of the valves in a seed-vessel.

Secundus, unilateral, or leaning all towards one side.

Segments, the divisions of leaves, cups, or blossoms.

Semicylindrical, *semicylindraceus*; applied to leaves flat on one side, and convex on the other.

Seminal leaves, *folia seminalia*, are the first leaves of the plant after the cotyledons have ceased to exercise their functions.

Sempervirens, evergreen.

Sepals, are the divided portions of the calyx.

Serrated, *serratus*; applied to leaves which have margins resembling the teeth of a saw.

Serrulatus, minutely serrated.

Sessile, *sessilis*; applied to parts placed directly on the branch or stem, or growing from the root without any footstalk.

Sheathing or vaginant, *vaginans*; applied to leaves, the base of which converge and enclose the bud.

Silicula, a pouch.

Siliqua, a pod.

Simple, *simplex*; applied to leaves which consist of a single leaf.

Sinuuated, *sinuatus*; applied to leaves divided in their margins into wide semicircular openings.

Smooth, *glaber*; having a soft even surface.

Solid, *solidus*; applied to stems having no cavity, and to bulbiferous roots, which seem to be uniform in their structure.

Solitarius, solitary; applied to parts which stand singly or alone on a plant.

Spadix, an elongated kind of receptacle.

Sparsus, scattered.

Spatha, a spathe or sheath, is a kind of calyx, which forms a sheath to the flower, and opens longitudinally.

Spatulatus, spatulate; applied to leaves of a roundish figure, tapering and linear at the base.

Spear-shaped, shaped like a spear.

Species, a set of plants which agree in the general structure of their flowers and fruit, and therefore belong to the same genus, but differ

in their stem, leaves, or other minor particulars.

Spica, a spike, is a species of inflorescence in which the flowers are collected in whorls or groups on an elongated common peduncle.

Spicula a spikelet, applied to a collection of little florets on one stalk, as the Grasses.

Spina, a thorn.

Spinosus, spinous; applied to parts covered with thorns.

Sporules, little bodies found on ferns.

Spreading, *diffusus*; spreading wide, and separating the various parts as much as possible, as Fumitory and Tansy.

Stamen, a stamen, is one of the essential parts of a flower situated in the corolla.

Stem, the trunk of a plant which supports the leaves, branches, and flowerstalks, or flowers; it rises immediately from the root or bulb.

Stigma, a stigma, is the top of the pistil, being either of a round, lobed, or pointed form.

Stipes, a stipe, is the stem of a frond; applied also to funguses, and by some authors to the stem of some monocotyledonous plants.

Stipula, stipule; a leafy appendage, placed at the part of the stem where the footstalk or

leaf arises. Stipules vary in number, form, and arrangement.

Stoloniferous, putting forth suckers.

Straight, *rectus*; applied to parts which are without curvature.

Striatus, striated; applied to stems with parallel lines.

Straw, the stem of a grass.

Strobilus, strobile; a seed-vessel composed of woody scales enclosing the seeds. A strobile is a hardened catkin.

Stylum, style; the part of the pistil which elevates the stigma.

Submerged, *submersus*, *vel demersus*; applied to parts growing under water.

Subrotundus, roundish.

Subsessile, leaves having very short footstalks.

Subulatus, awl-shaped.

Suckers, *stolones*, are shoots which spring from the root, spread along or under the ground and then take root themselves.

Sulcatus, sulcate or furrowed; applied to parts impressed with deep parallel lines.

Superior, a term applied to the calyx or corolla when it is placed above the germen.

Sword-shaped, *ensiformis*; applied to leaves of

two edges, slightly convex on both surfaces, tapering to a point.

Syngenesia, the name of the Nineteenth Class; having anthers united, and flowers compound.

Tail, *canda*; is an elongated appendage, sometimes feathery.

Target-shaped, round and flattened, something like the under side of a saucer, or the head of a common brass nail.

Tendril, *cirrhus*; an appendage to plants, of a spiral form, which clasps round other bodies, to support the plant.

Teres, round.

Terminalis, terminal; applied to a peduncle terminating a stem, or to a flower proceeding from the extremity of the stem or branches.

Terna folia, leaves growing in threes.

Ternatus, ternate; applied to leaves consisting of three leaflets.

Tetradynamia, the name of the fifteenth class; six stamens in each flower, four long and two short.

Tetragynia, the name of one of the orders, in several of the classes; four pistils in each flower.

Tetragonus, or *quadrangularis*; square.

Tetrandria, the name of the fourth class; having four stamens in each flower.

Thorn, *spina*; a sharp projection proceeding from the wood.

Three-edged, *trigonus*; applied to leaves with three sides and three angles.

Three-nerved or ribbed, *trinervis*; having three ribs unconnected with the base or margin.

Three-sided, *triqueter*; applied to stems having three flat sides.

Thyrsus, a bunch.

Tomentosus, tomentose; downy.

Tongue-shaped, *lingulatus*; applied to leaves of an oblong, thick, and blunt form, of the shape of the tongue.

Torus, the name applied by De Candolle to the receptacle.

Tree, *arbor*; a vegetable with a single woody trunk, divided at the top into branches, which live for many years.

Triandria, the name of the third class; with three stamens in each flower.

Trigynia, the name of one of the orders in several of the classes; three pistils in each flower.

Triangularis, triangular; applied to leaves having three sides, and to stems having three edges.

Trigonus, three-edged.

Trinervis, three-nerved.

Triply-ribbed, *triplinervis*; applied to leaves with parts branching off from the main rib just above the base.

Triqueter, three-sided.

Tuberosus, tuberose; applied to roots growing in solid and roundish form, like the potato.

Tubus, tube; the round hollow part of the corolla.

Tubular, *tubulosi*; applied to parts forming a cylindrical tube.

Turio, a young unexpanded shoot; as *Asparagus*, in the state when it is eaten.

Twining, *volubilis*; applied to parts which by their form wind round others.

Umbella, umbel; a peculiar form of inflorescence. Several stalks or rays of nearly equal length, converge over one common centre, so that the flowers form a kind of hemisphere, or resemble an open umbrella.

Unarmed, *inermis*; applied to margins of leaves devoid of spines or thorns.

Undulatus, undulated; applied to parts with their margins waved obtusely up and down.

Umbelliferous, a term applied to plants which produce their flowers in umbels.

Umbellule, a little umbel; in most umbelliferous plants, each spoke of the umbel has an umbellule at its end.

Under-shrub, a plant in which the lower part only of the stem is woody; but the upper part is herbaceous, and dies every year.

Unequal, *inequalis*; applied to leaves having the two halves of unequal size.

Ungulatus, hoof-shaped.

Uniflori, *biflori*, *triflori*, &c. bearing one, two, three, or more flowers.

Utriculus, a capsule resembling a bladder in shape; it does not open by valves, but falls with the seed: the utriculus seldom contains more than one seed.

Vaginant, sheathing.

Valves, the pieces which compose a seed-vessel; the term is also applied to the projecting substances which, in some blossoms, close the mouth of the tube.

Variegatus, variegated.

Varieties, plants of the same species which differ slightly from each other; as in colour, size, or some other unimportant circumstance.

Veil, *calyptra*; a conical covering of the capsule in several mosses, somewhat like an extinguisher.

Veinless, *avenis*; applied to leaves without veins or nerves.

Veiny, *venosus*; applied to leaves with their vessels more prominent than usual.

Verrucosus, warty.

Verticalia, perpendicular; both sides at right angles with the horizon.

Verticillatus, whorled.

Vexillum, a banner or standard.

Villosus, villous or shaggy; applied to parts covered with long soft hairs.

Viscidus, viscid; applied to parts covered with a clammy juice.

Viviparous, is a term used where the seeds germinate upon some part of the parent plant, instead of falling to the ground.

Volubilis: vide Twining.

Volva, volva; a species of calyx or wrapper, a membranous covering of the fungus.

Warty, *verrucosus*; applied to parts beset with hard tubercles.

Wavy, *repandus*; applied to margins of leaves bordered alternately with minute segments of circles and angles.

Wedge-shaped, *cuneiforme*; applied to leaves broad at the base, and tapering towards the point.

Wheel-shaped, *rotatus*; applied to corollas salver-shaped, but without the tube.

Whorl, *verticillus*; a species of inflorescence in which the flowers surround the stem, in a circular form, or part of it only.

Whorled, *verticillatus*; applied to leaves growing in a circle round the stem.

Wing, *ala*; a light appendage to some seeds, by means of which they are wafted into the air.

Winged, *alatus*; applied to stems with the angles expanded into leafy borders, and to other parts under similar circumstances.

Woody, like wood, not herbaceous; as the principal stem of the wallflower.

Wooly, *canosus*; covered with short silky hairs feeling like wool.

DESCRIPTION OF PLATES.

(PLATE FACING THE TITLEPAGE.)

Fig. 1. A Bean. *a.* The *Micropyle*. *b.* The *Hilum*. *c. c.* The two Cotyledons enclosed in their coverings, the *Testa* and *Tegmen*.

2. *a.* The inner surface of one Cotyledon, the other being removed. *b.* *Testa*. *c.* *Tegmen*. *d.* The *Gemmule* or Plumelet. *e.* Caulicula, or young stem. *f.* The Collum. *g.* The root descending.

3. *Nymphæa Lutea*. *a. a. a.* *Testa*. *b.* *Tegmen*. *c.* *Hilum*. *d.* *Chalaza*, or *internal Umbilicus*. *e.* *Raphe*. *f.* *Perrisperm* or *Albumen*. *g.* *Embryo*. *h.* *Micropyle*.

4. A Pome. *a.* *Epicarp*. *b.* *Mesocarp*, or *Sarcocarp*. *c.* *Endocarp*.

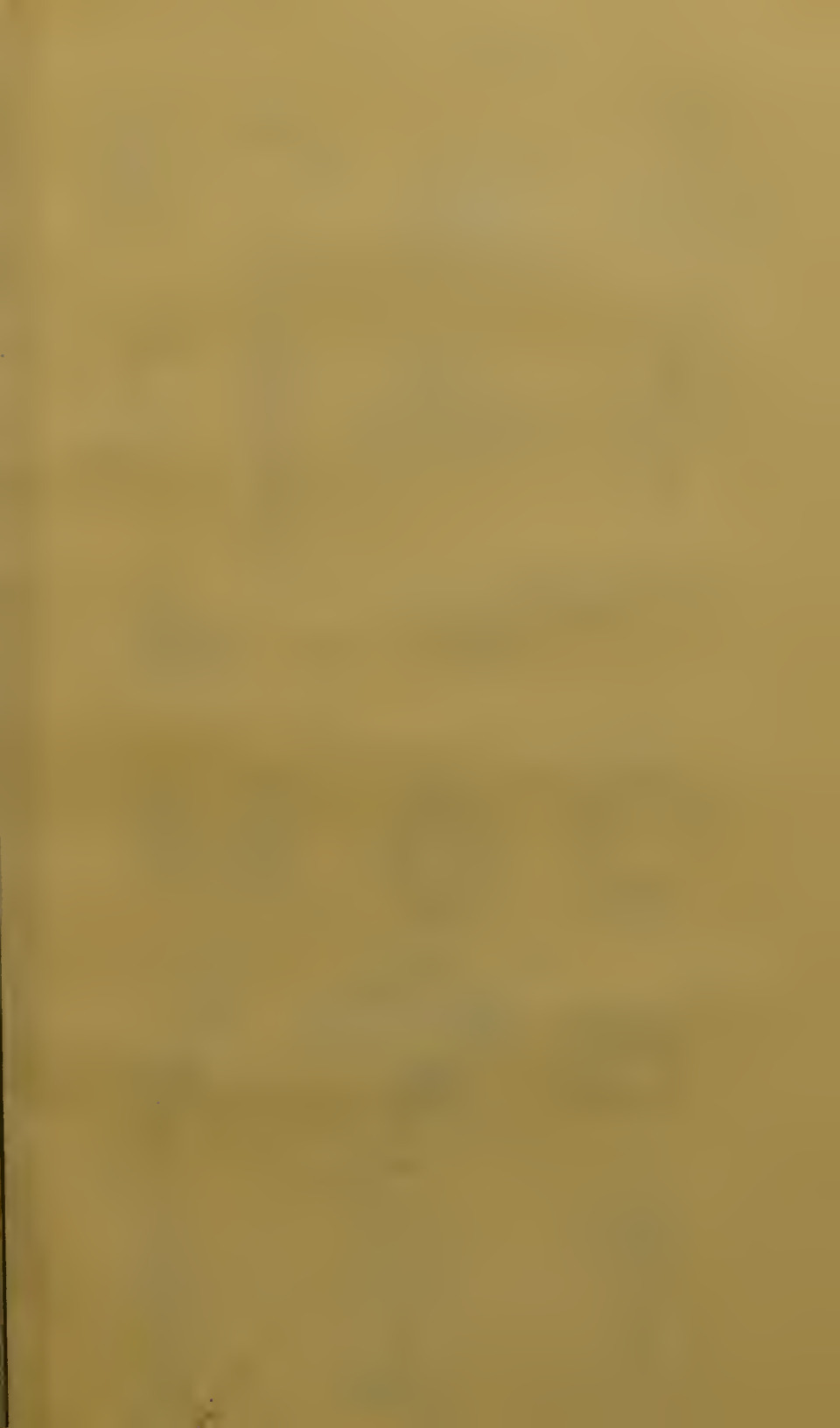
5. *a.* Seed-coats. *b.* *Albumen*, surrounding the Embryo. *c.* Embryo.

6. *a.* A Nutmeg enclosed in its coats, and surrounded by the *Arillus* *b.*

7. *a.* Seed of the *Ricinus*, with an appen-

dage in the site of the Hilum, called a *Caruncula*.

8. *a.* Seed-coats. *b.* The Cotyledon which is single. *c.* The Radicle which has a proper integument, called a *Coleorhiza*. *d.* The Plumelet, invested also with a covering, the *Coleoptile*.
9. Seed of *Alpinia Occidentalis*. *a.* Perisperm. *b.* A *sacciform appendage*, or *vitellus*, surrounding the embryo, *c.*
10. *a.* Represents the farinaceous Perisperm. *b.* The Cotyledon, elongated. *c.* The Plumelet. *e.* Coleorhizæ, surrounding the roots. *f.* The principal root. *g.* Rootlets which emerge laterally, each surrounded by a Coleorhiza.
11. *a.* The descending root. *b.* The Cotyledons expanded, forming *seminal leaves*. *c.* The young stem. *d.* *Primordial leaves*. *e.* Buds in the axilla, or angle formed by the leaf and stem.
12. *Oryza Sativa*. Monocotyledonous. *a.* *b. c.* The Plumelet. *a.* The external portion, called, by Mirbel, *Pileolus*. *d.* The *Coleoptile*, burst by the Plumelet. *f.* *Coleorhiza*. *e.* The *Collum*. *g.* The root. *h.* The Cotyledon. *i.* Albumen, or Perisperm.



Plante. 2.

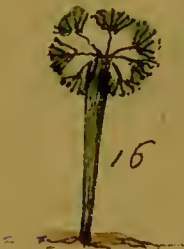
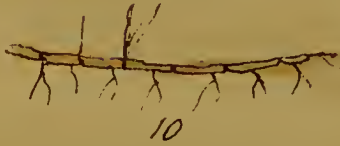
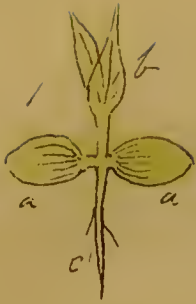


PLATE II.

ROOTS AND STEMS.

- Fig. 1.* *a.* The Cotyledons.
 b. Primordial Leaves.
 c. The Radicle.
2. *a.* The Cotyledons, before being expanded.
 b. The Plumelet.
 c. The Radicle.
3. A Tuberosc Root, as the *Potato*.
4. Ditto, Palmate, as the *Orchis*.
5. Ditto, Knotted.
6. Ditto, Round, as the *Turnip*.
7. Ditto, Abrupt or Præmorse, as the *Scabiosa Succisa*.
8. Ditto, Spindle-shaped, as the *Carrot*.
9. A Fibrous Root, as the *Grasses*.
10. A Creeping Root.
11. Bulbiferous Root, Tunicated or Lamel-
 lated, as the *Onion*.
12. Ditto, Solid, as the *Crocus*.
13. Ditto, Scaly, as the *Lily*.
14. Granulated Root, as the *Saxifrage*.
15. A Trunk of a Tree.
16. A Stipe.
17. A Culm.
18. A Scaly Stem.
19. A Scape.

PLATE III.

LEAVES.

- | | |
|-----------------------------------|------------------------------------|
| <i>Fig.</i> 1. Obovate. | <i>Fig.</i> 22. Acute. |
| 2. Ovate. | 23. Emarginate,
end-nicked. |
| 3. Roundish, sub-
rotund. | 24. Truncated,
præmorse. |
| 4. Subcordate. | 25. Gladiated,
bladed. |
| 5. Orbicular. | 27. Deltoid, delta-
like. |
| 6. Cuneiform,
wedge-shaped. | 28. Ensiform,
sword-shaped. |
| 7. Spatulate. | 29. Crenate,
notched. |
| 8. Unequal, sawed. | 30. Obcordate. |
| 9. Linear. | 31. Appendaged. |
| 10. Lanced. | 32. Sinuous, un-
equal. |
| 11. Awl-shaped. | 33. Lyre-shaped. |
| 12. Thread-like. | 34. Auricled,
eared. |
| 13, 14. Cordate,
heart-shaped. | 35. Fiddle-shaped,
panduriform. |
| 15. Kidney-shaped. | 36. Convolute. |
| 16. Semi-lunar. | |
| 17. Falcated. | |
| 18. Halberted. | |
| 19. Arrowed. | |
| 20. 26. Claviform. | |
| 21. Obtuse. | |

Plate .3.



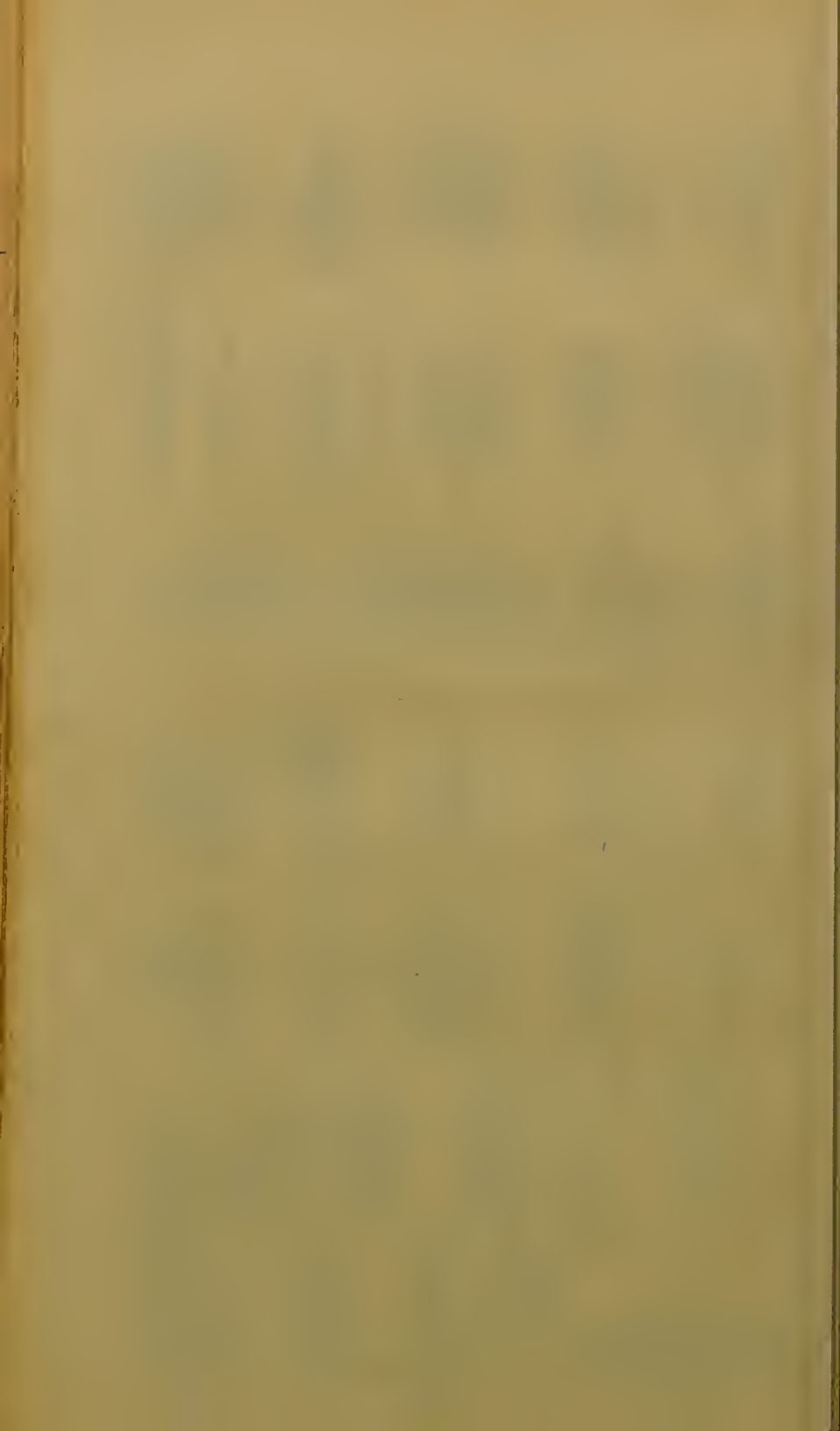


Plate iv



PLATE IV.

LEAVES.

- Fig.* 1. Petioled.
2. Palmate.
3. Runcinate.
4. Feather-cleft.
5. Sinuated.
6. Three-lobed.
7. Compound.
8. Pinnate.
9. Fan-shaped.
10. Perfoliate.
11. Bipinnate.
12. Stipuled.
13. Biconjugate.
14. Whorled.
15. Connate.
16. Stem clasping.
17. Geminate, in pairs.
18. Sheathing.
19. Distichous, or alternate.
20. Decurrent.
21. Imbricated.
22. Decussate.
23. Opposite.

PLATE V.

COROLLAS AND NECTARIES.

- Fig.* 1. A Bell-shaped Flower.
2. Salver-shaped.
3. Funnel-shaped.
4. Cruciform.
5. Personate.
6. Ringent.
7. Wheel-shaped.
8. Rosaceous.
9. Papilionaceous.
10. Vexillum, the Standard.
11. Ala, a Wing.
12. Orchidian Flower.
13. A Liliaceous Flower.
14. A Tubular Flower.
15. A Stamen.
16. A Pistil, consisting of Germen, Style,
and Stigma.
17. The Nectary of Aconitum Napellus.
18. The Spur-shaped Nectary of the Larkspur.
19. The Nectary of a Petal of the Ranunculus.
20. The Nectaries of Parnassia Palustris.
21. Ditto the Iris.
22. Ditto Tiger Lily.
23. Ditto Hellebore.

Plate 5



Plate 6.

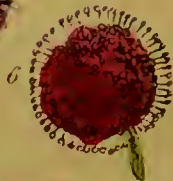


PLATE VI.

INFLORESCENCE.

- Fig.* 1. Amentum, a catkin.
2. Spica, a spike.
3. Racemus, a cluster.
4. Panicula, a panicle.
5. Thyrsus, a bunch.
6. Capitulum, a head or tuft.
7. Corymbus, a corymb.
8. Cyma, a cyme.
9. Fasciculus, a fascicle.
10. Verticillus, a whorl.
11. Umbella, an umbel.
12. Cephalanthus, a compound flower.
13. Strobilus, a strobile.
14. Sertulum.
15. Spatha, a sheath.

PLATE VII.

F R U I T S.

- Fig.* 1. Capsula, a capsule.
2. Samara, the seed-vessel of the *Maple*.
3. Coccum, an elastic seed-vessel.
4. Utriculus, a little bladder-like seed-vessel.
5. Folliculus, a follicle.
6. Legumen, the seed-vessel of the *Pea* tribe.
7. Siliqua, a pod.
8. Silicula, a silicle.
9. Nux, a nut; as the *Acorn*.
10. A berry, *Gooseberry*.
11. Drupa, stone-fruit, as the *Cherry*.
12. A Peach divided.
13. A Cherry divided.
14. The fruit of the Medlar.
15. Pomum, a Pome; as the Apple.
16. An Apple divided.
17. Strobilus, a cone.
18. A compound berry.
19. The berry of the wild Rose.

Plate 7.



Plate 8

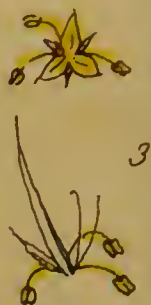


Plate 9.



PLATE VIII.

SEXUAL CLASSIFICATION OF LINNÆUS.

- Fig.* 1. Monandria, one stamen.
2. Diandria, two stamens.
3. Triandria, three ditto.
4. Tetrandria, four ditto.
5. Pentandria, five ditto.
6. Hexandria, six ditto.
7. Heptandria, seven ditto.
8. Octandria, eight ditto.
9. Enneandria, nine ditto.
10. Decandria, ten ditto.
11. Dodecandria, twelve ditto.
12. Icosandria, twenty or more ditto, inserted into the calyx, or corolla.

PLATE IX.

13. Polyandria, stamens numerous, inserted into the receptacle.
14. Didynamia, four stamens, unequal.
15. Tetradynamia, six ditto, ditto.
16. Monadelphia, stamens united into one bundle.
17. Diadelphia, stamens united into two bundles.
18. Polyadelphia, stamens united into several.
19. Syngenesia, compound flowers, stamens united.
20. Gynandria, stamens inserted into the pistils.
21. Monœcia, sexes separate on same plant.
22. Diœcia, sexes separate on two plants.
23. Polygamia, sexes united or separate on the same or separate plants.
24. Cryptogamia, sexes indistinct.





